THE UNIVERSITY OF ALBERTA

THE EFFECT OF SOCIO-ECONOMIC STATUS ON THE DEVELOPMENT OF AUDITORY DISCRIMINATION AS IT RELATES TO READING ACHIEVEMENT

by

DOLORES JOAN FAST

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "The Effect of Socio-Economic Status on the Development of Auditory Discrimination as it Relates to Reading Achievement" submitted by Dolores Joan Fast in partial fulfilment of the requirements for the degree of Master of Education.

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ABSTRACT

Reading authorities suggest that one of the important factors in the process of learning to read, is that children can auditorily discriminate the sounds within words and relate these phonemes to their grapheme counterparts. The ability to discriminate speech sounds and to combine these sounds into words varies according to the individual differences among students, one such difference being the socio-economic status of the individual.

The purpose of this study was to compare the auditory discrimination of selected speech sounds of first grade students in low socio-economic areas with that of grade one students in other than low socio-economic areas; and to examine the relationship between auditory discrimination and reading achievement of these 120 first grade students.

From a test population of 612 students, a test sample of 120 students was selected using a table of random numbers. The sample was subsequently divided into four groups: low socio-economic status - low reading achievement; low socio-economic status - other-than-low reading achievement; other than low socio-economic status - low reading achievement; and other than low socio-economic status - other than low reading achievement. Each of the four groups consisted of thirty students. The Metropolitan Reading Achievement Test, Primary 1, Form B, served as the primary basis for designating students to either a low or other than low reading achievement group.

Each child was given an individual audiometer test, and those children with hearing deficiencies were excluded from the study and replaced with other randomly chosen students. The Fast-Cosens Auditory Discrimination Test was then administered to each student individually to determine the auditory discrimination of these students, and to relate the findings to reading achievement.

Analysis of the data utilizing one-way and two-way analysis of variance revealed a significant positive relationship between auditory discrimination and reading achievement, and between auditory discrimination and socio-economic status at the .01 level of confidence.

The study also showed that when correlating auditory discrimination scores of the students with their chronological age, sex, and intelligence, there was a significant relationship between auditory discrimination and intelligence quotients only.

In analysing the Fast-Cosens Auditory Discrimination Test, the findings revealed that the same pattern of difficulty was common to the students of both socio-economic groups, but the degree of difficulty experienced by the L.S.E.S. group was greater than that of the O.S.E.S. group. Glides were the easiest type of sounds for all students to distinguish. On the other hand, the nasals were the most difficult items for students from both socio-economic status groups. When consideration was given to voicing, the voiced fricatives were the most difficult items. In analysing

word pairs on position of sound in the words, the final stops and the affricates were the most difficult items to distinguish.

Since auditory discrimination is significantly related to reading achievement and to socio-economic status, a well developed auditory discrimination training program warrants special emphasis in the initial school year for children in low socio-economic areas.

It appears that the phonemes which surround the particular speech sounds compared in minimal word pairs affect the discriminability of these word pairs. Therefore, research is needed to determine how sounds influence the discriminability of other sounds in words.

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I. THE PROBLEM

Although word perception is only one component of the complex process of reading, it is a most important aspect of reading. Gray (32:10) states, "Word perception is the all important basis of the reading process and the individual cannot comprehend or assimilate ideas unless the words which convey these ideas are identified correctly."

Upon entering school, the beginner is generally taught to read a few printed words that are common in his speech. The child, therefore, uses some of the words of his oral language which he has acquired in pre-school years as the basis for his reading vocabulary. Through using these words in meaningful situations and through repetition in various ways, the child builds up a 'sight' vocabulary. The term 'sight' word is used to denote a printed word that the child learns to recognize by looking at it as a whole, without the aid of any word analysis technique. Since a 'sight' reading vocabulary is limited to the number of words a child can visually recall, another approach to the teaching of reading is introduced as soon as possible. This approach would feature the gradual learning of associations of sound symbols with their corresponding letter symbols or graphemes within words.

Thus, the reading process includes the translating of printed or written symbols into sound symbols and then into meaning. This implies that the child must hear the sound symbols as separate entities in the words before he can be expected to associate those sounds with their grapheme counterparts. In learning to read, therefore, the child relies heavily on auditory clues, and he must be able to hear and distinguish the separate sounds in spoken words, as well as be able to synthesize these sounds rapidly and effectively into words.

Vernon (73:58) contends that the abilities to give words containing a given phonetic sound, and to blend sounds into words, are important for success in reading.

Wepman (75:326) in his sample found that 27 per cent of grade one and 19 per cent of grade two children showed inadequate auditory discrimination and that these children were retarded in reading. He concluded that "there is a positive relation between poor discrimination and poor reading."

Discrimination of speech sounds comes only with experience and practice in responding to oral language. Deutsch, C. (16:278) states that "it is only through experience which involves consistent exposure to particular auditory stimuli that a child comes to discriminate sound, and to recognize words." Smith (67:42) contends that the child as a result of listening to adults, "adapts his babblings to words," and in this way "auditory discriminations first

take place and continue to multiply." The development of auditory discrimination, so essential to adequate language development is also an important factor in the initial stages of learning to read.

Children upon first entering school, differ in their ability to discriminate speech sounds. Investigations by Wepman (77) and Templin (70), among others, show that certain sounds have not been mastered in speech by all children in grade one. It may be that the sounds which children cannot articulate correctly are those not sufficiently discriminated by primary children. Those not discriminated well may be those which cause the most trouble in beginning stages of learning to read.

It is highly possible that the lack of verbal communication and experience of the lower-class child causes the development of his auditory discrimination to lag behind that of children from other socio-economic areas. Deutsch, M. (17:171) says that, "the lower-class home is not a verbally oriented environment." While the environment may be noisy, sufficient verbal interaction using the quality of language acceptable in classrooms may not be present. The child, therefore, learns inattention and does not develop auditory discrimination of speech sounds as readily as other children. Thus, the lower-class child may begin school with an auditory handicap which in turn may retard progress in reading. Since the environmental background of a child does affect the rate of acquisition of oral language, it follows that the rate of acquiring correctly articulated

speech is also affected by the environmental background of a child. Furthermore, research (56,70,76) also reveals that auditory discrimination of speech sounds is closely related to articulation of speech, and together they are an integral part of learning to read. Therefore, the problem under consideration attempts to assess student discrimination of specific auditory speech sounds in various socio-economic grade one groups and the relationship to their reading achievement.

II. PURPOSE OF THE STUDY

Since auditory discrimination appears to be necessary to achievement in the initial stages in learning to read, it was the purpose of this study to compare the auditory discrimination of selected speech sounds of grade one students in low socio-economic areas (L.S.E.S.) with that of grade one students in other socio-economic areas (O.S.E.S.) to assess the effect of socio-economic status on the development of auditory discrimination as it relates to reading achievement. The study attempts to identify specific auditory discrimination difficulties in selected speech sounds.

III. QUESTIONS WHICH THE STUDY SOUGHT TO ANSWER

Auditory discrimination test scores of first grade students will be studied in relation to the impact of factors of: reading achievement, sex, socio-economic status, intelligence, and

chronological age, at the first grade level. The following questions were posed.

1. Does the auditory discrimination ability of the student affect his reading achievement?

2. Does the socio-economic status of the student affect his auditory discrimination ability? His reading achievement?

3. Is the student's reading achievement, his socio-economic status, and his auditory discrimination ability inter-related?

4. What effect do the variables of sex, intelligence, and chronological age have on the auditory discrimination of grade one students of varying levels of reading achievement and in different socio-economic statuses?

IV. HYPOTHESES

From the questions posed the following hypotheses were formulated and tested.

1. In analysing auditory discrimination scores there will be:
   - a. no significant <u>main</u> effect due to reading achievement,
   - b. no significant <u>main</u> effect due to socio-economic status,
   - c. no significant <u>interaction</u> between reading and socio-economic status,
   - d. no significant <u>simple</u> main effects for reading,
   - e. no significant <u>simple</u> main effects for socio-economic status.

2. There will be no significant correlation between auditory discrimination and the following variables:

a. sex,
b. intelligence as measured by the Lorge-Thorndike I.Q. Test,
c. chronological age,

when each of the above is calculated on the basis of:

1. the total test sample,
2. L.S.E.S. and low reading achievement,
3. L.S.E.S. and other-than-low reading achievement,
4. O.S.E.S. and low reading achievement,
5. O.S.E.S. and other-than-low reading achievement.

In addition, the following question will be answered using step-wise linear regression. Which set of variables has a significant relationship to auditory discrimination, as measured by the Fast-Cosens Auditory Discrimination Test, and within this set, what is the rank order of these predictors?

V. DEFINITION OF TERMS

1. Auditory Discrimination:

This will refer to the ability to hear likenesses and differences in sounds when presented in word pairs which differ one word from the other by only one sound. The measurement instrument will be the Fast-Cosens Auditory Discrimination Test.

2. Low Socio-economic Status: (L.S.E.S.)

L.S.E.S. is the numerical rating assigned to children whose parents score within class six or seven on the Blishen Occupational Class Scale, 1961. This scale was developed from the Canadian Census, 1951 according to the combined standard scores for income and years of schooling of adults and is used to determine the class distribution of groups of people in the Canadian social structure.

3. Other Socio-economic Status: (O.S.E.S.)

O.S.E.S. is the numerical rating assigned to children whose parents score within classes one to five on the Blishen Occupational Class Scale, 1961.

4. Grade Level:

This will refer to the "years of elementary schooling" for each child. In this study, only students in their first school year were included. Any child who continued grade one for a second consecutive year was eliminated from the study.

5. Low Reading Achievement: (Low. Rdg. Ach.)

This will be defined as those students whose grade score in reading is 2.00 or less on the Metropolitan Reading Achievement Test, Primary 1, Form B.

6. Other-Than-Low Reading Achievment: (O.T.L. Rdg. Ach.)

This will be defined as those students who receive a grade score of greater than 2.00 on the Metropolitan Reading Achievement Test, Primary 1, Form B.

VI. POSSIBLE SOURCES OF ERROR

1. It was assumed that the students in this study have accurately understood the directions given to them regarding the various tests, and that they are using the same criteria as the administrator in the selection of their choice of test answers.

2. It was also assumed that the information which the experimenter took from the cumulative record folders of the students was accurate.

VII. LIMITATIONS

The interpretations of the findings of this study should be made only after considering the following limitations:

1. The sample is limited to a Canadian city of 120,000 people in which there are few if any extremely low or high socio-economic groups.

2. Since there are no kindergartens operating in the Saskatoon Public Schools, not all children have had kindergarten experiences. Thus, the amount of auditory training the children in this study received prior to grade one entrance was varied.

VIII. OVERVIEW OF THE STUDY

This section will briefly describe the experimental setting, and state the statistical processes used in analysing the data.

From a test population of 316 first grade students, the entire population of four schools in the low socio-economic areas; and 296 students, the entire population of four schools in other socio-economic areas in the Saskatoon Public Schools, a test sample of sixty children in each socio-economic area was selected from the 612 students using a table of random numbers.

The designation of the school as one in a low socio-economic area and that of an area other than low socio-economic, was made by school officials. The Blishen Occupational Class Scale, 1961, was then used to verify the socio-economic status of each child.

The following data were collected from the cumulative record folder of each student:

1. Sex of student
2. Occupation of father
3. Occupation of the mother if presently employed. The mother's previous occupation prior to home making was also obtained through a telephone conversation with each mother.
4. Scores on the Monroe Basic Reading Test - Pre-Primer Level
5. Scores on the Monroe Basic Reading Test - Primer Level
6. Scores on the Lorge-Thorndike Intelligence Test, Level 1, Kindergarten and Grade One (see Appendix E)
7. The results of the Maico Audiometer Scores.

The following tests were administered by the experimenter:

1. The Metropolitan Reading Achievement Test, Primary 1, Form B. (See Appendix D)

This test was given to verify the reading achievement level of each student as indicated by the Monroe Basic Reading Tests.

2. Since there is no test available to assess a wide range of specific auditory discrimination difficulties, a test instrument was constructed by the experimenter and a colleague to investigate specific auditory discrimination difficulties in children. This instrument will be referred to as the Fast-Cosens Auditory Discrimination Test (see Appendix A).

The Fast-Cosens Auditory Discrimination Test, prepared by two experimenters was then administered to each student individually. This test attempted to measure the ability of the child to discriminate accurately between word pairs which differ only by one sound in each word pair.

The data were analysed using one and two-way analyses of variance, correlations and intercorrelations, step-wise linear regression, and a test item analysis of the Fast-Cosens Auditory Discrimination Test.

IX. SIGNIFICANCE OF THE STUDY

Although studies have indicated that children in low socio-economic status areas appear to have more auditory discrimination problems than other children, details of the specific difficulties in speech sounds necessary for reading achievement are lacking. This study attempts to extend teacher understanding of particular problems in auditory discrimination encountered by children in grade one. If distinctions in auditory discrimination exist between socio-economic groups, auditory training programs appropriate to the specific group should be considered in curriculum planning.

It is hoped that the auditory discrimination test constructed for this investigation may provide an additional auditory discrimination measurement for use of reading specialists.

X. SUMMARY

This chapter attempted to show the necessity of a study to investigate the effect of socio-economic status on the development of auditory discrimination as it relates to reading achievement. Since the sample was selected from a Canadian city generalizations from the findings would be limited to cities of similar size and composition.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter attempts to show the relationship of auditory discrimination to the reading process. By referring to the literature, an attempt is made to affirm the necessity of a study of this nature. It further considers previous investigations in the area of auditory discrimination.

Research indicates that in cases of low achievement in reading, there is generally some inability to hear the separate sounds of letters and letter combinations in words, as well as the inability to synthesize the sounds to produce a word. This does not necessarily mean that a child does not have the ability to hear sounds, but that he simply lacks the ability to distinguish one sound pattern from another, or to fuse these sounds to produce a word.

This chapter reviews literature relevant to auditory discrimination and factors influencing reading achievement. Section one reports on auditory discrimination and reading achievement and sections two, three, and four the relationships of socio-economic status, sex, and intelligence to reading achievement.

I. AUDITORY DISCRIMINATION AND READING ACHIEVEMENT

Auditory discrimination refers to the ability of a student to distinguish one sound pattern from another in word discrimination. It is possible that some students can hear words, but are unable to distinguish between minimal word pairs. That is to say, the hearing acuity of the child may be functioning normally but he has not acquired the ability to discriminate between the finer nuances of words. This ability to discriminate auditorily appears to improve with maturation and training. As an aspect of the reading process, auditory discrimination affects the child's ability to associate one to one correspondence of the phoneme - grapheme relationship.

An investigation by Monroe (57:93-94) comparing a control group of thirty-two randomly selected first grade students with thirty-two reading defects, indicated that the control group made fewer errors in auditory discrimination. The mean chronological age of the control group was six years and nine months, the mental age was seven years and four months; the experimental group's mean chronological age was eight years and five months, while their mean mental age was eight years and four months.

Monroe's test consisted of twenty word pairs. Some of the word pairs were the same, and some were different. The different word pairs were minimal pairs, that is, with only one phonemic change in the word.

The results of this experiment indicated that although the control group was younger chronologically and less mature mentally than the experimental group, they still made fewer errors in auditory discrimination. Monroe concluded:

> Lack of precise auditory discrimination was found to impede the learning which involves auditory impressions. The lack of auditory discrimination of certain sounds may lead to a confusion of words, which in turn affects speech, or reading, or both. (57:95)

Durrell and Murphy (22) reported that the correlation between auditory discrimination and reading achievement was found to be .56, .52, and .52 in grades one, two and three respectively. On the basis of this study, they concluded that the ability to notice separate sounds in spoken words was a highly important factor in predicting reading achievement. Dykstra (23), Wepman (75), and Bond (7) agree with Durrell (20) that weaknesses in auditory discrimination is one of the most important and most frequent occurring causal factors in reading disability. Durrell (22) further advocates an intensive auditory training program for first grade students to help them develop the ability to hear separate sounds in words and to synthesize these sounds to produce words. He states:

> One of the background skills in reading which most affects learning rate is the ability to notice separate sounds in spoken words. The lack of this ability was almost universal among children who came to our clinic as non-readers. Although the child may have had thorough phonic training which enabled him to give sounds for all letters and combinations, he had never noticed that spoken words contained those sounds. The result was that the child was unable to use phonics. (20:205)

Several additional studies have been conducted to show the relationship between auditory discrimination and reading achievement in the first school years. Among these was a study conducted by Dykstra (23) in which seven measures of auditory discrimination and reading achievement were administered in the fall of the year to 632 grade one students. Dykstra used eight classrooms which were selected by a stratified random sample. Three schools were chosen from a high socio-economic area, three schools from a middle socio-economic area, and two schools were classified as low socio-economic. Relationships between auditory discrimination and reading achievement were attained using correlations. The auditory discrimination tests administered included discrimination of initial consonants in word pairs, and final consonants in word pairs, rhyming and auditory blending. From the statistical analysis Dykstra concluded that four measures of auditory aptitudes and the intelligence quotient, were significantly related to reading achievement. These four measures were: rhyming - as tested by the Gates Rhyming Test; making auditory discriminations - as tested by the Harrison-Stroud Test; discrimination of ending sounds - as measured by the Murphy-Durrell Discrimination Test; and using context and auditory clues as measured by the Harrison-Stroud Test. Dykstra's (23) findings revealed that auditory blending, discrimination of beginning sounds, and chronological age were not significantly related to reading achievement. He emphasized that poor auditory discrimination is frequently the cause of reading

disability in young children. He agrees with Durrell (20:203) that the ability to notice the separate sounds in spoken words is a highly important factor in determining a child's success in learning to read.

Reid (63), an investigator at the University of Alberta, examined various aspects of auditory abilities in relation to reading readiness. She examined the auditory abilities of 112 children entering first grade in an Edmonton school, to determine how these abilities were related to reading achievement by the end of the school year. Auditory memory and auditory discrimination tests were administered both at the beginning and at the end of the first grade. The Auditory Fusion Test was taken from the Betts Ready to Read Tests. Here the child was asked to blend the phonemes that the administrator vocalized in order to present specific words. Wepman's Auditory Discrimination Test, Form A, was also administered to each child individually in which he would indicate whether the word pairs were the same or different. Reid found that the auditory discrimination tests were significantly related to both oral reading and to word recognition skills. She states:

> It is now essential that other factors such as auditory acuity, abilities to perceive likenesses and differences in speech sounds and ability to remember sounds and words when heard, should be considered. It is possible that such factors when tested in conjunction with intelligence might greatly aid in determining which children are ready for reading, . . . when phonetic teaching should begin and which methods will best suit the individual child. (63:8)

This ability to discriminate tends to increase with maturity. Betts (4:129) contends that some children do not hear likenesses and differences in phonemes of words, while other children cannot discriminate between words and thus run their words together. He suggests that children be given an auditory training program during the reading readiness period, and that this extend into the reading program. He further studied causes or reasons for inadequate auditory discrimination ability of children, and proposed that hearing impairment, poor environmental background experiences, and mental immaturity were primary causes for disability in auditory perception. Betts states:

> Accurate auditory discrimination contributes to good speech habits and to an awareness of speech which are essential to phonetic insight. In view of this, it is clear that inaccurate auditory discrimination may contribute to a reading deficiency. (4:129)

Wepman (75) agrees with Kennedy (43) and Thompson (71) that the ability to discriminate sounds is a developmental process. Wepman further suggests that a child's auditory development in discrimination is generally mature by about age eight, and that success in reading is related to the ability to discriminate likenesses and differences in sounds. Wepman (75) obtained data from an experiment using 150 grade one students, as well as clinical cases, and developed an auditory discrimination theory:

First, there is evidence that the more nearly alike two phonemes are in phonetic structure, the more likely they are to be misinterpreted.

Second, individuals differ in their ability to discriminate among sounds.

Third, the ability to discriminate frequently matures as late as the end of the child's eighth year.

Fourth, there is a strong positive relation between slow development of auditory discrimination and inaccurate pronunciation.

Fifth, there is a positive relation between poor discrimination and poor reading.

Sixth, while poor discrimination may be at the root of both speech and reading difficulties, it often affects only reading or speaking.

Seventh, there is little if any relation between the development of auditory discrimination and intelligence. (75:326)

Wepman (75) further postulates that with increased ability to discriminate sounds, the child's speech becomes more and more like that of his environment.

Ervin and Miller (25) suggest the the more variety of speech sounds that a child is exposed to, the greater the range of sounds a child will use.

McNeil and Stone stated that:

> Accurate phonetic analysis is presumed to require understanding by the child that the sound pattern of a word is divisible into smaller units and these units or parts are common to the sound patterns of other words. (53:13)

This analysis involves the ability to hear each sound and to reproduce each one in order. If the order is changed a different word or sound pattern results.

An investigation by Wheeler and Wheeler (78:106-111) tested four areas of auditory discrimination in grades four, five and six. The tests were designed to examine the ability of students to discriminate sounds in auditory language situations. The tests consisted of:

1. Twenty-five word pairs, some of which were the same and some of which were different.

2. The second test contained sound elements, rather than whole words.

3. This test contained rhyming words.

4. The last test consisted of discriminating sounds within words.

Wheeler and Wheeler (78) found auditory discrimination to be highly significant to success in silent reading, with a significance at the .01 level of confidence. They concluded "some children may make more use of auditory discrimination than others in reading . . ." In spite of the scarcity of research in this area, most educators seem to agree that the ability to discriminate between speech sounds is a basic factor in reading readiness and in subsequent reading development. (78:106)

Hester (37:172) after examining 194 reading problem cases, reported that auditory discrimination and blending were more difficult processes than naming letters. She found that phonics difficulties rapidly increased during the second and third grades, particularly if the child was unable to synthesize sound elements into words.

Similar findings to those of Hester's were reported in a longitudinal study by Chall, Roswell, and Blumental (11). They noted that children with "severe reading disabilities also had extreme difficulty in learning phonics, particularly in blending and synthesizing sounds" (11:113). Their experimental group consisted of sixty-two first grade negro children, and they proposed to determine a relationship, if any, between auditory blending ability, reading achievement, and intelligence. Their findings indicated that there was a significant relationship between auditory blending in grade one and reading achievement in grade three. However, they found no significant correlation between auditory blending and intelligence. Findings revealed that auditory blending abilities in grades one to four inclusive, were positively correlated with reading achievement.

Contrary to the findings of Chall, Roswell and Blumental's study (11), Reid (63:107) found that there was a definite relationship between intelligence and reading achievement.

Summary

Research has indicated that auditory discrimination is an important aspect of reading achievement. Many authorities (7,14,20, 23,76) agree that inability to discriminate auditorily is frequently a causal factor of poor reading. The literature (43,71,75) indicates that auditory discrimination is a developmental process and therefore increases with maturity. The rate of development can be increased through a training program.

II. SOCIO-ECONOMIC STATUS AND READING ACHIEVEMENT

It is a truism that children do not come to school equally prepared for the learning tasks that confront them. Research reveals that aspects of the home environment play an important role in rate of development and acquisition of learning tasks of the individual student. There is ample research evidence to indicate that children from low socio-economic homes generally have poorer oral language ability than do children from middle-class homes, and that children who are not proficient in oral language are also those who are poor in reading achievement (17,18,44,47).

The young child comes to perceive many aspects of his environment. This perceptual development takes place through his sense modalities and is stimulated by his environment. If the child's experiences are rich in verbal communication he will probably advance rapidly in his oral language as well as in his

auditory discrimination abilities. On the other hand, a child who lacks sufficient verbal communication may develop his oral language and his ability to discriminate word elements more slowly. Deutsch, C. (16:278) and Smith (67:42) both emphasize the principle that children must be exposed to oral language in order to develop auditory perception to recognize words and to discriminate sounds in words.

Hunt, while reflecting on Piaget's work, stated:

> The rate of development is in substantial part . . . a function of environmental circumstances. Thus, the greater the variety of situations to which the child must accommodate his behavioral structures, the more differentiated they become. Thus the more new things a child has seen and the more he has heard, the more things he is interested in seeing and hearing. Moreover, the more variation in reality with which he has coped, the greater is his capacity for coping. (40:258-259)

Thus he contends that lack of enrichment and failure to provide a variety of stimuli contribute to retarded rates of development of perceptual skills.

This postulation is also supported by Deutsch, M. (17:80) who maintains: "the children from slum backgrounds tend to have poorer and less systematic ordering of stimulation sequences."

Bernstein (2) contends that grossly different environments affect aspects of language development. He further hypothesizes that:

> Lower working-class children will experience difficulty in learning to read, in extending their vocabulary, and in learning to use a wide range of possibilites for the organization of verbal meaning; their reading and writing will be slow and will tend to be associated with a concrete content..... (2:164)

Armstrong stated that:

> A general cause of poor progress in beginning reading might be insufficient preparation in oral language; a particular cause might be poor auditory discrimination resulting in faulty pronuncation, which in turn cause inadequate matching of sound and symbol in beginning reading. (1:59)

Clark and Richards (13) conducted a study on auditory discrimination in the low socio-economic areas of Madison, Wisconsin. Their study consisted of 58 pre-school aged children enrolled in a Headstart program. Twenty-nine of these children were classified as economically disadvantaged. Their mean chronological age was five years and one month, with a mean I.Q. of 91.8. The control group consisted of twenty-nine nondisadvantaged children, with a mean chronological age of four years and eight months, and a mean I.Q. of 110.8. The Wepman Auditory Discrimination Test was administered to each child individually from a tape recording so as to insure consistency in articulation. Analysis of covariance was used, removing each of the dependent variables in turn. From the findings, Clark and Richards (13:261) concluded that "preschool economically disadvantaged children exhibit significant deficiencies in auditory discrimination ability when compared to a nondisadvantaged group." It could be that these children have a poorer attention span due to

inexperience and lack of opportunity to tend to the task of listening.

Deutsch, M. (17) found that lower-class children were significantly below middle-class children in auditory discrimination ability. He also contends that poor readers have significantly more difficulty in auditory discrimination than do good readers, with differences being greater for the lower classes. Deutsch further postulates that:

> . . . the child learns to be inattentive in the pre-school environment, this further diminishes incoming stimulation. ... if this trained inattention comes about as a result of his being insufficiently called upon to respond to particular stimuli, then his general level of responsiveness will also be diminished. The nature of the total environment and the child-adult interaction is such that reinforcement is too infrequent, and, as a result, the quantity of response is diminished. (17:171)

A series of similar investigations on auditory discrimination as a factor in verbal behavior and in reading success of lower socio-economic students was conducted by Deutsch, C. (16). Data were gathered in connection with several different projects. As a result, there is inconsistency of statistical treatment as well as of measures employed from one sample to the next. However, in all investigations the Wepman Auditory Discrimination Test was administered to each student. Her sample included students from grades one, three, and five. Her conclusions indicated that

> . . . poor readers have more difficulty with auditory discrimination; they have greater difficulty shifting from one modality to another, ... the retarded readers showed a significant relationship between auditory discrimination and reading scores. (16:292)

Deutsch (16) postulated that children living in a noisy environment with little directed speech stimulation might be deficient in their discrimination of speech sounds. These children would probably be inattentive to auditory stimuli and have difficulty with auditory discrimination. "Discriminations come only with experience and practice in responding to the stimuli" (16:278).

This hypothesis is consistent with that of Deutsch, M. (19:80) when he states, "There is a paucity of organized family activity in lower-class homes, as a result there is less conversation." Deutsch, M. (19:253) further stated,

> A child who has been deprived of a substantial portion of the variety of stimuli to which he is maturationally capable of responding, is likely to be deficient in the equipment required for school learning.

Raph reviewed studies in language development among socially disadvantaged children, and from this analysis concluded:

> Language acquisition for socially disadvantaged children is more subject to a lack of vocal stimulation during infancy, a paucity of experience in conversation, a deficit in the auditory-vocal modality, a meagerness of quantity and quality of verbal experiences, and a slower rate and slower level of articulatory maturation. (61:396)

Silberman (65:38) substantiates Raph's conclusions by stating that, "slum children may lack the sense of auditory discrimination ... the ability to distinguish very subtle differences and nuances in sound that is essential to reading."

Bernstein holds that:

> The linguistic relationship between the lower class mother and her child is such that little pressure is placed on the child to verbalize in a way which signals and symbolizes his unique experience. The shift of emphasis from non-verbal to verbal signals, in the middle-class mother-child relationship, occurs earlier and the pattern of verbal signals is far more elaborate. (2:167)

Thus Bernstein implies that the mother-child relationship is an important aspect in the development of the child's oral language.

An experimental study was conducted by Mortenson (58) to determine how children of upper, middle, and lower socio-economic levels differ in their performance of both visual and auditory skills. The sample consisted of 1500 children selected by means of a stratified random sample. Three auditory discrimination tests were given. These included discrimination of beginning sounds, vowel sounds, and ending sounds. Results indicated that the higher the socio-economic status of the beginning first grade child, the higher was the performance on pre-reading auditory and visual discrimination tasks and on a measure of intelligence. Furthermore, beginning first grade girls performed significantly better than first grade boys on the pre-reading auditory discrimination tasks. Finally, with intelligence held constant, the higher socio-economic child performed significantly better on all but two discrimination tasks, namely, visual discrimination of words, and auditory discrimination of vowel sounds.

Ervin and Miller (25:110) state that the

> . . . hearing of a variety of speech sounds may increase the range of sounds used by the child, but we do not know if the hearing of a particular range of sounds influences the particular range used by the child.

Finally, Edwards (24) notes that if the child perceives inaccurately and articulates incorrectly as many culturally differentiated learners do, this may hamper his development of word recognition skills. He will have difficulty associating printed symbols with the written counterparts. Edwards concluded by suggesting:

> Auditory discrimination develops within a social environment in which a special system of speech sounds prevails. One becomes accustomed to hearing and reproducing those speech sounds, but when a new one obtrudes from an alien speech sound system, there is a tendency toward perceptual distortion as one hears and reproduces it in accordance with its nearest equivalent within the more familiar speech sound system. This inaccurate perception and reproduction of standard American English speech hampers the recognition skills: he has trouble associating printed symbols with their spoken counterparts because he never really mastered their spoken counterparts. (24:547-548)

<u>Summary</u>

Auditory perceptual development is stimulated by the child's environment. Research above has indicated that if a child's experiences in verbal communication have been restricted, his oral language development and his auditory discrimination will probably advance more slowly than a child who has had a well stimulated and rich verbal environment. It therefore appears that children from lower socio-economic areas have greater difficulty in auditory

discrimination, and this in turn hampers their development of word recognition.

III. SEX DIFFERENCES AND AUDITORY DISCRIMINATION

Numerous researchers (43,51,63,76) have reported significant differences in reading achievement between boys and girls. Smith (67), Monroe (57), and Bond (7) have indicated that the majority of retarded readers are boys. Furthermore, success in auditory discrimination appears to be highly indicative of reading success. Since auditory discrimination is a developmental process, and since girls generally develop and mature more rapidly than boys, it follows that their ability to discriminate auditorily would also be superior to boys.

Mortenson (58) in a study which included 1500 children from high, average and low socio-economic levels, revealed that first grade girls performed significantly better than boys on three auditory discrimination tests. In the first test the children were asked to discriminate between pictures which began with the same sounds. That is, the test involves initial consonant comparisons. The second test involved vowel sounds. Here the item was presented verbally, and the child responded by selecting the correct picture. The third auditory discrimination test included word endings. The child was asked to draw a line through one of three pictures that ended the same as the initial or stimulus picture. The differences

between boys and girls were significant at the .01 level of confidence, in each of the socio-economic groups, in favor of girls.

Spache, et al (68:581) in a longitudinal study of a first grade reading readiness program contend that there are systematic differences between the growth curves of boys and girls. "Girls generally experience their period of rapid growth earlier than boys." Wyatt (80:596) confirms Spache's hypotheses by stating "boys have been shown to be less mature both physically and linguistically than are girls at the age of six."

An investigation of grade one students by McAulay (51:208) indicated that, "all of the observed differences in means for the auditory tests favored girls." She further indicated that the Monroe Test of Sound Blending, and the Auditory Aptitude Test, showed significant differences in favor of the girls. McAuley concluded that:

> . . . superior performance of the girls, on tests of auditory and motor aptitude, suggests that maturational sex differences . . . may be a factor that is operative in the girls' favor. (51:208)

Auditory discrimination requires attending to the sound elements of words. The child's inability to discriminate may therefore, be due to immaturity. Thus it would appear that since boys as a group mature at a slower rate than girls, their auditory discrimination achievement also lags behind that of girls.

Reid (63) and Wepman (76) both indicated that auditory development is slower in boys than in girls. However, neither of

these two investigations looked specifically at the auditory development within children of different socio-economic groups.

Dykstra (23:21) also noted that girls were "significantly superior in three out of seven auditory tests, while boys failed to hold an advantage in any." Moreover, the girls in his sample were significantly younger than the boys.

Silvaroli and Wheelock (66:247) in an investigation of auditory discrimination training for beginning readers state:

> It appears unrealistic to assume that all children have acquired the associative conceptual process of discriminating basic speech sounds by the time they are required to begin major reading programs. The assumption is even more unrealistic for children in lower socio-economic environments. (66:247)

A study on socio-economic status and language facility of beginning first graders was conducted by Worley (79). He worked with children between the ages of five years eleven months, and six years eleven months. Each child was given the Illinois Test of Psycholinguistic Abilities, in order to determine the language ability of each child. Worley concluded that boys scored higher on the Illinois Test of Psycholinguistic Abilities than girls in each socio-economic group. The girls of the low socio-economic group scored the lowest of all. He concluded that boys had better language ability than girls, but he failed to indicate precisely what aspect of language was measured.

A further investigation by Labensohn (44) on vocabulary development and different socio-economic groups of first grade

students agrees with the findings of Worley (79). Labensohn found that first grade boys from the lower-class homes have better oral language ability than girls from lower-class homes.

Summary

A review of the literature reveals that in the majority of cases, auditory development is slower in boys than girls. It appears that auditory discrimination is a developmental process, and since girls mature physically more rapidly than boys, that their auditory abilities also develop at a faster rate than boys.

IV. INTELLIGENCE AND READING ACHIEVEMENT

The relationship between intelligence and success in reading has been emphasized by several researchers (7,23,51). However, there is some discrepancy as to the significant relationship between intelligence and reading achievement (57).

Bond (7:69-71) studied 379 fifth grade children and noted that while there was a positive relationship between reading and intelligence, there was also a considerable range in reading achievement to be found among fifth grade students at any intelligence level. He also indicated that children with intelligence quotients between 95 and 124 as measured by the Stanford-Binet Intelligence Test, accounted for much of the heterogeneity. He emphasized that children with intelligence quotients of 125 or higher

are not to be found among the poor readers. Likewise, there are few with intelligence quotients below ninety-five among the very able readers. Bond states:

> It is most accurate to say that low intelligence is not itself a direct cause, but that it may lead indirectly to reading disability. (7:113)

Chall, Roswell, and Blumenthal (11) in their longitudinal study of auditory blending and reading achievement found that intelligence was not significantly correlated with auditory blending in grade one. However, there was a significant relationship between auditory blending and reading achievement.

McAuley (51:203) on the other hand, found that there was a significant correlation between intelligence and auditory discrimination for boys. However, there was no significant correlation between intelligence and auditory discrimination for girls.

In a research study of 415 children with special reading problems, Monroe (57:17) found that the reading index, although resembling the intelligence quotient somewhat in its distribution, did not correlate very highly with it. She states:

> . . . There is, however, a tendency for the children whose reading achievements are above expectation to have somewhat higher intelligence than those children whose reading achievements are below expectation. (57:17)

The 415 children in the experimental group were clinic cases, while the 101 children in the control group were representative of an "average American school population." (57:2).

Deutsch, M. (19) and Bernstein (2) found that lower-class children perform more poorly on intelligence tests than do students from other socio-economic groups.

In his longitudinal study of elementary school children, Loban (47) found the highest correlation between vocabulary and intelligence. Children in the highest oral language ability group had high intelligence quotients, and were higher in reading achievement than other groups. The children high in oral language ability represented children of the high socio-economic status group. Thus, it appears that intelligence and socio-economic status are interrelated, and that together they are indicative of the level of success in reading achievement.

Summary

While there is not complete agreement, there is some consensus among reading authorities that reading achievement and intelligence are closely related. Smith (67) indicates that the intelligence quotient is a good predictor of reading success. The interrelationship of intelligence and socio-economic status may, however, be a more valid predictor for success in reading than intelligence alone.

V. SUMMARY OF THE CHAPTER

This chapter has reviewed research pertaining to auditory discrimination, and to factors of socio-economic status, intelligence quotient and sex differences, which influence reading achievement. Research holds that auditory discrimination is closely related to reading achievement during the early school years. Language development appears to be closely related to socio-economic status, and is interrelated with auditory discrimination. Intelligence also appears to be related to both socio-economic status and reading achievement, and thus influences achievement scores on auditory discrimination tests. There is substantial evidence to indicate that boys encounter more difficulty in learning to read than girls, and there is some evidence that auditory development is slower in boys than in girls. This may be explained by the fact that girls mature physically earlier than boys.

CHAPTER III

CONSTRUCTION OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

I. INTRODUCTION

The importance of auditory discrimination has been well documented by many reading authorities (57,68,75). There is also substantial evidence (16,18) to indicate that the development of oral language and of auditory discrimination are interrelated, and that together they influence reading achievement of the individual student.

Experimental evidence (2,3,47) supports the hypothesis that oral language develops according to a maturation pattern. The development of correctly articulated speech sounds is an integral part of this language growth. Research also reveals (56,70,76) that there is a close relationship between articulated speech and the auditory discrimination of speech sounds. Thus it appears that speech articulation and the auditory discrimination of speech sounds are integral parts of oral language development of the student and subsequently of his ability to learn to read.

The process of reading is a highly skilled and complex activity which necessitates the translating of printed or written symbols into thought content. Four major components of the reading process are:

1. Word perception which involves identification of the printed symbol;

2. Comprehension of ideas and interpretation of meaning;

3. Reaction of these ideas, which involve a mental or cognitive process; and,

4. Integration of these ideas. (33)

For the purpose of this investigation, consideration is given primarily to the relationship between auditory discrimination and the acquisition of word perception skills as one aspect of the reading process.

Dechant (14:143) contends that many children who do not progress satisfactorily in reading "lack sufficient auditory discrimination to hear the differences between sounds." This ability in auditory discrimination is a part of the general word perception reading program because a student who cannot hear the separate sounds in spoken words cannot be expected to associate the visual symbol with the auditory symbol readily. Furthermore, inaccurate auditory discrimination may lead to inaccurate articulation of speech sounds and thus to incorrect association of the sound symbol with the printed symbol. If a child distorts sounds in his speech, it could be more difficult or even impossible for him to associate the correct sound or phoneme with the grapheme. Therefore, as Dechant (14:143) states, "The learner must discriminate the phonetic elements that make up the word" before reading can occur. The student must make "appropriate

association between the spoken and the written word" (14:143). If the sounds within words are not heard correctly, interpretation of these sounds and their association to the printed symbol become a task which many students fail to accomplish.

Since auditory discrimination is a developmental process (14,71,76), and if, according to Wepman (76), children have not mastered all speech sounds until age eight, first grade students will encounter difficulty with those sounds which are discriminated last. Dechant (14:144) states that "six year olds are unable to distinguish correctly between the sounds of: /g-k/, /m-n/, and /p-b/." He further suggests that the high frequency sounds of: /f,v,s,z,š,ž,ð,θ,t,d,p,b,k,g/ are the most difficult to discriminate (see Table III). In the reading process, children must learn that words consist of a sound or a sequence of sounds, that the same sound may occur in many words, and that most words are unique in that they generally are composed of a combination of different sounds and symbols different than other words. Many words contain sounds which are difficult for first grade students to discriminate and therefore the association of their grapheme correspondents in the word perception reading program is a difficult task to accomplish. Durrell and Murphy (22) contend that the child who finds learning to read least difficult is generally one who can discriminate the distinct sounds in spoken words.

It is on the premise that auditory discrimination and speech articulation are considered an integral part of the reading process, that the present investigation and the construction of the test instrument were undertaken.

The next section of this chapter presents a theoretical background of the Fast-Cosens Auditory Discrimination Test. It further shows the relationship between auditory discrimination and articulation of speech sounds, as well as reviews research on the order of acquisition of speech sounds. Definitions of terms apposite to the research instrument are also presented. Following this a detailed explanation of the construction of the Fast-Cosens Auditory Discrimination Test is given and the basis for selection of particular test items included. Next, an analysis of Wepman's Auditory Discrimination Test is considered in order to determine the types and positions of sounds included in his test, and to identify those sounds which were not included by him. Then justification of the items included in the Fast-Cosens Auditory Discrimination Test is presented, as well as a report of each sound comparison made. Finally, an explanation of the pilot study, the administration of the newly constructed test instrument, and the validity and reliability of the Fast-Cosens Auditory Discrimination Test are discussed.

II. THEORETICAL BACKGROUND OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

An inherent problem of tests which measure the ability to recognize or produce words with similar sounds is that they often require visual stimuli such as words or pictures or both. The possibility of incorrect identification of visual stimuli affects the validity of the auditory discrimination scores; thus, an auditory discrimination test prepared by the experimenter and a colleague was employed to ensure the elimination of visual stimuli. This test consisted of minimal word pairs which were presented on a tape recording.

Dykstra (23) found in his study that there was little justification for giving more than one or two auditory discrimination measures. "Very little improvement in the accuracy of prediction can be expected as a result of giving an entire battery of auditory discrimination tests...." (23) On the basis of Dykstra'a findings it was decided to construct and administer one comprehensive test rather than an entire battery of tests which had been previously used in experimental studies similar to the present study.

There has been little research carried out in the area of auditory discrimination and almost none to determine the kinds of discrimination errors which do occur. The only study found to date which made an analysis of specific auditory discrimination errors

was that of Miller and Nicely (56). They limited their analysis to consonants "since consonants are notoriously confusable and are quite important for intelligibility" (56:153). They began with a comparison of sixteen consonants including the stops, nasals, and fricatives indicated on Table I.

The voiceless sounds are referred to as vl., and the voiced sounds as vd. Miller and Nicely (56) were able to pin point features of phonemes which were used as cues for discrimination. In order to describe the consonants used in the study, they adopted the following features as a basis for classification; "voicing, nasality, affrication, duration, and place of articulation" (56: 165-166). Affrication refers to the friction noise that distinguishes /f, θ, s, š, v, ð, z, ž/, from other consonant sounds, due to the articulatory position in which air is forced through the mouth. Duration refers to the long, intense, high-frequency sounds of /s, š, z, ž/, which are the grooved fricatives.

In order to determine the kinds of discrimination errors, five females served as talkers and as listeners. While one articulated the consonant sounds in nonsense words, the other four listened using earphones. Each of the sixteen consonants was spoken initially before the vowel /a/, as in "father". Each nonsense word was spoken at a rate of one every 2.1 seconds. Miller and Nicely (56) found that some features are more discriminable than others. Voicing and nasality are the most easily discriminable

TABLE I

CONSONANT PHONEMES ANALYSED BY MILLER AND NICELY

Types of Sounds		Points of Articulation					
		Bilabial	Labio-dental	Interdental	Alveolar	Alveo-palatial	Velar
Stops	vl.	p			t		k
	vd.	b			d		g
Fricatives	vl.		f	θ (thin)	s	š (sure)	
	vd.		v	ð (that)	z	ž (azure)	
Nasals		m			n		

features. For example, it is relatively easy to discriminate between voiced and voiceless sounds; and between nasal and non-nasal sounds, but it is much more difficult to discriminate between the sounds characterized by duration and the rest of the consonants; and between the fricatives and the non-fricatives. It is most difficult to discriminate between places of articulation in the mouth: front: (/p, b, f, v, m/,), middle (/t, d, θ, s, ð, z, n/,), and back (/k, g, š, ž/,). They further found that the distinctions between /f/ and /θ/, and between /v/ and /ð/ were among the most difficult to hear. Since Miller and Nicely (56) found the discrimination between voiced and voiceless sounds, and between nasals and non-nasals the easiest to discriminate, these comparisons were not included in this study. However, consideration was given to place of articulation as this aspect of sound discrimination was more difficult for students.

Unfortunately, Miller and Nicely confined their analysis almost entirely to consonants in the initial position of a word. Unlike this analysis, the Fast-Cosens Auditory Discrimination Test considered the initial, medial and final position of sounds in words. Although Miller and Nicely, in determining the kinds of discrimination errors, examined sixteen consonants preceded by the short vowel sound /ǎ/, this study attempted to consider each con-

sonant comparison with different vowel sounds preceding and following the consonants compared.

Olmsted proceeded from evidence of Miller and Nicely to theorize that:

> . . . at any stage before the phones of the language are learned to asymptote, there are more errors based on place of articulation than on friction or duration, and more errors based on place, friction, or duration than on voicing or nasality. (59:533)

To obtain additional information on discrimination of sounds, it was necessary to consult research on articulation to identify the relationship between auditory discrimination and speech articulation to determine which sounds in which position of a word at each age level, caused auditory discrimination difficulties.

A basic assumption has been made in this study that there is a close relationship between articulation and discrimination of speech sounds. This assumption is based upon Olmsted's Theory of the Child's Learning of Phonology, (59:531) in which he predicts that "learning as measured by correct pronunciation is a function of ease of perception of sound". He predicts that the more discriminable sounds are learned earlier than the less discriminable ones.

There are also several articulation studies which indicate a close relationship between the child's correct pronunciation and his discrimination of speech sounds. Research on articulation of speech has therefore been considered for this study in order to

determine the types of errors in articulation encountered by children, and then to determine whether these errors were also those not discriminated auditorily. Christine and Christine (12:99) found the relationship between auditory discrimination and articulation defects to be significant at the .01 level of confidence.

Wepman (77) in a clinical study conducted in the University of Chicago Speech Clinic, using the Wepman Auditory Discrimination Test, reported that twenty-two children out of twenty-four with articulation problems showed inadequate auditory discrimination.

Monroe in a review of clinical cases states that:

> The child models his articulation to match the auditory pattern of a word as presented by another. When he can give himself the same auditory stimulus which is given by another person, the word will appear to himself to be correctly articulated. If his auditory discrimination is poor, he may confuse similar words in both speech and reading without recognizing the error. (57:93)

The order of acquisition of speech sounds has been investigated by several experimenters. Several studies have attempted to ascertain the age at which children begin to use various speech sounds, and the age at which these sounds are correctly articulated. Early investigators used a questionnaire method to determine the age of mastery of speech sounds. This method proved to be weak from the standpoint of accuracy of information. One such questionnaire survey of articulation in the South Dakota public elementary schools was undertaken by Root (64). Judgments regarding speech defects

were made according to definitions which were printed on a questionnaire. Root failed to indicate who was responsible for filling out the questionnaire. The results indicated that 9.3 per cent of grade ones and 4.0 per cent of grade eights had speech defects. When all grades from one to eight inclusive were considered, the percentage of speech defects was 6.3. The ratio of boys to girls with speech defects was one and one-half to one.

In 1931, Wellman et. al. (74) studied 204 preschool children, ages two to six inclusive. The investigators recorded sounds which were made spontaneously by the children in response to pictures and questions. Thus they listened for all sounds in all positions within a specific word. Because of the complexity of pinpointing the articulation error, this method is perhaps less reliable than that in which only one sound in one position in a word is being considered at a time.

Poole and Templin (70) in independent studies, found that 75 per cent or more of their test sample between the ages of three and four and one half years articulated the following consonants correctly: /m, n, ŋ, p, h, w, j, k, b, g,/. Both Wellman et. al. (74) and Templin (70) found 75 per cent correct articulation of /f/ at age three, and 75 per cent correct articulation of /d, r, s, ch/, between the ages of four and five years.

In articulation of speech sounds, research reveals that there is a sequential development in the acquisition of speech sounds.

This sequential development will be discussed in section IV of this chapter, and the justification for selecting particular items will be discussed in section VI of this chapter.

Summary

A significant relationship between articulation and auditory discrimination has been found by several investigators (12,70,75). This relationship has been further supported by Olmsted's Theory of the Child's Learning of Phonology in which he postulates that more easily discriminable sounds are learned earlier than less discriminable ones (59:531).

III. DEFINITION OF TERMS APPOSITE TO THE RESEARCH INSTRUMENT

The following definitions are apposite to the description of the research instrument, the Fast-Cosens Auditory Discrimination Test.

Stops; Stops are consonants in which the flow of air is stopped or obstructed when articulated. The stops include /p,t,k/ and /b,d,g/.

Fricatives; Fricatives are the "nine consonants which are produced by an obstruction of the air stream causing audible friction." These are: /f,v,θ,ð,s,z,š,ž,h,/ (69:22). For example;

θ as in "thin"
ð as in "then"
š as in "shun"
ž as in "azure."

Affricates; Affricates are a special type of stops. Here the closure of the stops is gradually released to permit a slight friction noise. The sounds /č/ and /ǰ/ as in "chill" and "Jill" respectively, are the two affricates.

Nasals; Nasals are the sounds which are produced by forcing air through the nasal cavity. The nasal sounds of English are; /n,/m,/ŋ/. For example; /ŋ/ as in "ring."

Lateral: Lateral is the /l/ sound, "made by placing the tongue on the alveolar ridge and vibrating the vocal cords as the air passes out on both sides of the tongue" (69:24).

Glides: Glides are sounds produced by a vibrating tongue position. They are; /r,y,w,/ and are all voiced sounds (69:24).

Voiced: Speech sounds produced while the vocal cords are vibrating are said to be voiced.

Voiceless: Speech sounds produced while the vocal cords do not vibrate are said to be voiceless.

Bilabial: Bilabial is a speech sound produced by closing the two lips, with or without the addition of voicing (60) (69). Bilabial sounds are: /p,/b,/m/.

Labiodental: This is a speech sound produced with the lower lip against or touching the upper teeth. Labiodental sounds are: /f,/v/.

Interdental: This speech sound involves articulation of the tongue between the upper and lower teeth (60) (69). The interdental sounds are: /θ,/ð/.

Alveolar: This is a speech sound produced with the position of the "tongue permitting a small stream of air to hiss over its surface at the alveolar ridge" (69:23). The alveolar ridge is the teethridge (60:233). They are: /t,/d,/s,/z,/n,/l,/r/.

Alveopalatal: The alveopalatal is a production of speech sound with "the point of articulation near the teethridge and front part of hard palate" (60:233). They are: /š,/ž,/č,/ǰ,/y/.

Velar: This is a speech sound produced with the point of articulation at the soft palate in order to close the nasal cavity (60) (69). These sounds are: /k,/g,/ŋ,/w/.

Phonemes: A phoneme is a significant unit of sound. It is "a speech sound that signals a difference in meaning" (69:8).

IV. CONSTRUCTING THE FAST-COSENS AUDITORY DISCRIMINATION TEST

The relatively low correlation on the Wepman Auditory Discrimination Test found by some investigators may indicate that some of the items do not clearly discriminate between children with good and poor auditory discrimination. This possibility warranted the construction of a revised and lengthened word-pairs test by the experimenter and a colleague.

The data presented by Miller and Nicely (56) and the theoretical extension of Olmsted (59) provide basic guidelines for choosing items directed toward probable trouble spots in auditory discrimination. Miller and Nicely (56) indicated that voicing and

nasality are the most discriminable features of speech sounds and that friction, duration and place of articulation are much less discriminable. In construction of the Fast-Cosens Auditory Discrimination Test, no items have been included which require discrimination between voiced and voiceless sounds, or between nasal and non-nasal consonant sounds. Items have been chosen which require discrimination involving friction, duration, and place of articulation.

The items on the Fast-Cosens Auditory Discrimination Test were based on an analysis of articulatory defects, as well as on discrimination errors. The principle reference for determining specific articulatory defects was Templin's Certain Language Skills in Children (70). Since a close relationship between speech and auditory discrimination has been established, Templin's study is relevant to the construction of the present instrument. Her sample consisted of children between the ages of three and eight.

Templin stated that 75 per cent of the children in her study articulated sounds as follows:

By age 3:
(a) initial, medial and final nasals
(b) initial and medial stops
(c) vowels
(d) diphthongs

By age 4:
(a) final stops

By age 5:
(a) final glides
(b) final affricates
(c) initial consonant blends

By age 6:
(a) initial, medial, and final fricatives

By age 7: (a) initial and final triple consonant blends

By age 8: (a) initial and medial affricates are not produced correctly by 75 per cent of the children (70:47-51).

Templin concluded that more articulation errors were made in the medial and final positions than in the initial position. She outlined each sound in the various positions and indicated the percentage of children at each age who had mastered the specific sound. The age at which sounds can be articulated correctly by most children differ slightly in the various studies. Table II shows these differences among the results reported by Templin, Wellman, and Poole. Despite these differences, it is apparent that articulation of speech sounds is developmental, and the order or mastery of speech sounds has been reported by researchers.

Another criteria for selecting items on the Fast-Cosens Auditory Discrimination Test, was information concerning the frequency of phonemes in the English language. In an earlier study that substantiates Templin's findings, Miller (55:86-88) reports that 38 per cent of the phonemes are vowels and diphthongs and 62 per cent are consonants. It has also been noted that some consonants are generally used at the beginning of words while others are used more extensively at the end of words. Some consonants are rarely used, thus these sounds were included in only a few comparisons on the test instrument. Miller further states (55:87) that "only five different sounds make up more than 50 per cent of the final consonants,"

TABLE II

AGE AT WHICH SPEECH SOUNDS ARE MASTERED BY STUDENTS AS REPORTED BY TEMPLIN, WELLMAN, AND POOLE

Speech Sound	Study Source		
	Templin	Wellman	Poole
m	3	3	3.5
n	3	3	4.5
ŋ	3	-	4.5
p	3	4	3.5
f	3	3	5.5
h	3	3	3.5
w	3	3	3.5
y	3.5	4	4.5
k	4	4	4.5
b	4	3	3.5
d	4	5	4.5
g	4	4	4.5
r	4	5	7.5
s	4.5	5	7.5
š	4.5	5	7.5
č	4.5	5	-
t	6	5	4.5
θ	6	-	7.5
v	6	5	6.5
l	6	4	6.5
z	7	5	7.5
ž	7	-	6.5
ǰ	7	6	6.5

four of which are /ng,z,v,r/. He fails to identify the fifth. On the other hand he indicates that the following sounds comprise 50 per cent of our initial consonants. These are; /w,j,h,b,g,f,p,ð,θ/.

Since vowels and diphthongs, according to Templin are mastered at age three, and since they comprise only 38 per cent of the English phonemes, it was decided to exclude these from the study. On the other hand, Miller (55) reported that 62 per cent of the phonemes are consonants, and therefore a concentrated study of English consonants was warranted. In order to focus careful attention on one aspect of auditory discrimination, blends were also excluded from the present study. Templin, Poole, and Wellman, as reported by Templin (70), have indicated that final consonants are mastered later than initial consonants, and that affricates and fricatives are mastered later than stops. Therefore, more comparisons have been made of consonants in the final position, and more comparisons have been made among fricatives, and affricates than among stops (see Chapter III, section VI).

Summary

In summary, the items for the *Fast-Cosens Auditory Discrimination Test* were chosen on the basis of:

(1) discrimination errors,

(2) articulation errors, and

(3) frequency of sounds in English.

V. AN ANALYSIS OF WEPMAN'S TEST

Lacking an analysis of the *Auditory Discrimination Test* by Wepman himself, an analytical breakdown follows:

I. Stops;

a) *Voiced*: Wepman has made the three possible comparisons of the bilabial /b/, alveolar /d/, and the velar /g/ in both the initial and final positions.

b) *Voiceless*: The three possible comparison among the bilabial /p/, alveolar /t/, and the velar /k/ in both initial and final positions were also made.

II. Fricatives;

a) *Voiced*: The only comparison made was between the labio-dental /v/ and the interdental /ð/ in both initial and final positions. The alveolar fricative /z/ was presented only in two 'like' pairs. The alveopalatal fricative /ž/ was not used in any comparison.

b) *Voiceless*: Every possible match of voiceless fricatives was made in the initial and final position.

III. Affricates;

The voiced /ǰ/ and voiceless /č/ affricates were tested only in 'like' pairs.

IV. Nasals;

Wepman contrasted the bilabial /m/ and the alveolar /n/ in the initial and final position, but included the velar /ng/ only in a 'like' pair. A 'like' pair refers to two words which have the same phonemic sounds.

V. Glides;

Comparisons between alveolar glide /r/ and the lateral /l/ were made only in 'like' pairs. The alveopalatal /y/ and the velar /w/, were not included in any comparison.

VI. Vowels;

Wepman made only four vowel comparisons in the medial position. None of these were diphthongs.

Consonants were not included in the medial position.

VI. JUSTIFICATION OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST ITEMS

Test items included in the research instrument have been carefully selected, and justification for each is indicated below.

1. Templin (70:44-45) found that more articulatory errors were made when consonants were in the medial and final positions, rather than in the initial position. Most errors occurred in the final position.

Consideration will be given to all sounds in any positions which 5 per cent of the children, at age six, cannot articulate correctly as reported by Templin (70:166-169).

2. Although Wepman (77) made every possible comparison of stops, Templin (70) found that the stops in the initial position have been mastered by children at age four. Therefore, comparisons among initial stops have been dropped from the Fast-Cosens Auditory Discrimination Test but comparisons of medial and final stops were retained.

3. Templin (70) and Wellman (74) found that the nasals have been mastered by age three, but Poole (70) found that children have not mastered the velar /ng/ and the alveolar /n/ nasals until age four and one half. Unlike Wepman's Auditory Discrimination Test, this instrument will compare the velar nasals with other nasals in the medial and final positions.

4. Templin (70:49) found that the voiceless fricatives are produced more accurately by a larger number of children than the voiced fricatives. Wepman, however, did not test the voiced fricatives.

In the present test instrument, every possible match of voiced and every possible match of voiceless fricatives have been prepared by the experimenter. Since Miller and Nicely (56) found that it is difficult to discriminate between fricatives and non-fricatives some comparisons have also been included.

5. The affricates were not mastered by 75 per cent of Templin's sample until age seven. Templin (70) further noted that contrasts of the voiced affricate with voiced fricatives and the

voiceless affricate with the voiceless fricatives were among the most discriminating items on her sound discriminate test (52,70,59). Therefore, the present test instrument has included the above contrasts.

6. Templin and Poole found that the alveopalatal /y/ and the velar /w/ are mastered by age four and one half. The alveolar /r/ glide and the lateral /l/ are not mastered until between age four and seven and one half. This instrument has included comparisons between /r/ and /l/. The /w/ has also been compared with the /r/ and /l/ in the initial positions because of observed differences of school children by classroom teachers.

7. Since Templin found that all vowels and diphthongs were articulated correctly by 95 per cent of the children by age six, comparisons among vowels have been excluded from this study.

Table III shows all phoneme comparisons made in the Fast-Cosens Auditory Discrimination Test. For example, /p/ has been compared with /t/ in the medial and final positions, and /p/ has been compared with /k/ in the final position.

Table IV indicates the twenty-four consonant phonemes of the English language as described by Stageberg (69:25). The only English phoneme not considered in the Fast-Cosens Auditory Discrimination Test was the /h/. This is the only glottal sound in English and thus could not be compared with any like phoneme.

TABLE III

ENGLISH CONSONANT PHONEMES COMPARED IN THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Type of Speech Sound		Stops vl			vd			Fricatives vl				vd				Aff.		Nas.			L.Gld.				Word examples of selected sounds
		p	t	k	b	d	g	f	θ	s	š	v	ð	z	ž	č	ǰ	m	n	ŋ	l	r	y	w	
Stops vl	p		v<	<				><	><																
	t	v<		v<																					
	k	<	v<																						
vd	b					<	<					><	><												
	d				<		<			<			<	><											
	g				<	<																			
Fricatives vl	f	><							><	v><	v><														
	θ	><						><		v><	v><														(thin)
	s					<		v><	v><		v><						v<								
	š							v><	v><	v><						v><									(sure)
vd	v				><								v><	v><											
	ð				><	<						v><		v><											(that)
	z					><						v><	v><				v><								
	ž																v								(azure)
Affricates	č										v><														(chill)
vd	ǰ									v<				v><	v										(jill)
Nasals	m																			v<					
	n																			v<					
	ŋ																	v<	v<						(ring)
Lateral	l																					v><			>
Glides	r																				v><				>
	y																								
	w																				>	>			

Key: > initial consonant comparisons made.
v medial consonant comparisons made.
< final consonant comparisons made.

TABLE IV

ENGLISH CONSONANT PHONEMES*

Type of Sound		Position of Articulators						
		Bilabial	Labiodental	Interdental	Alveolar	Alveopalatal	Velar	Glottal
Stops	vl	p			t		k	
	vd	b			d		g	
Fricatives	vl		f	θ	s	š		
	vd		v	ð	z	ž		h
Affricates	vl					č		
	vd					ǰ		
Nasals		m			n		ŋ	
Lateral					l			
Glides					r	y	w	

*Stageberg (69:25)

To minimize the influence of chance, which probably affected the Wepman Auditory Discrimination Test in which only one sound in one position was considered, three unlike pairs and three like pairs for each contrast of phonemes were included on the Fast-Cosens Auditory Discrimination Test. A few exceptional cases, however, are included. These are minimal pairs in the medial position which occur infrequently in the English language. In these eight cases, only two comparisons were made.

Word Controls

Two word controls were exercised in the construction of the Fast-Cosens Auditory Discrimination Test.

1. Sound Control:

The Gage Dictionary of Canadian English (28) was used as the authority on pronunciation, to determine whether the contrasts were actually minimal pairs.

2. Frequency Control:

Each of the word pairs was matched for familiarity by selecting words as close in frequency as possible from the Lorge-Thorndike Teacher's Word Book of 30,000 Words (72). This word list was used because it gave a frequency count of words actually included in reading material prepared for children and the intent of the present instrument is to investigate trouble spots in auditory discrimination which affect reading achievement. An attempt was made to select words at the primary grades level of difficulty, however, in some cases more difficult words were included.

<u>Summary</u>

The general consensus of the literature reviewed indicated that the medial and final positions of sounds were mastered later than the initial consonant sounds. Therefore, in this study, more comparisons were made of medial and final consonants. Since fricatives were found to be more difficult than stops, more fricative comparisons were made than stops. Table III shows the English consonant phonemes compared in the *Fast-Cosens Auditory Discrimination Test*.

VII. THE PILOT STUDY

A pilot study was conducted in Edmonton in March, 1968, to determine which items discriminate between subjects with good auditory discrimination and those with poor auditory discrimination. Only the most discriminable items were retained. The pilot study also indicated any refinements which would be desirable in the administration of the instrument.

The test was designed to determine a child's ability to recognize minimal differences that exist between the English phonemes used in speech. The test attempts to measure the subject's ability to differentiate between word pairs, and thus no visual ability is necessary. Only the subject's ability to hear accurately is required.

Each subject was asked to listen to a tape recording which contained word pairs. The examinee then indicated by concrete action whether the words were alike or different. If the words were different, he raised his hand but if the words were the same he kept his hand down. The subjects were given a few word pairs before the onset of the test, to ensure that they understood the procedure, and that they were working on the same criteria as the experimenter.

The test before revision consisted of 396 items including four minimal pairs and four like pairs for each contrast indicated above. It was administered individually to thirty-two grade one students from two Edmonton public schools. One school was in a low socio-economic area, and the other was in a middle class area. The test was given in three, twenty minute periods with a five minute intermission between each twenty minute period. The items were presented on a tape recorder to ensure that each word pair was heard with the same quality, pitch, stress, and time interval by all subjects. There was a four second interval between each word pair to give children sufficient time to make the desired response. This provided consistency of presentation and prevented the subjects from getting visual clues from the articulation of the administrator.

The recording was made in a sound proof room by the experimenter, a typical Canadian from a one language Western Canadian English speaking background. While taping, the recorders were outside the sound-proof room in order to minimize the motor noise of

the machines. The machines used to do the recordings were Sony, TC-105. Complete directions for administering the original test, as well as the revised test are included in Appendix A.

VIII. VALIDITY AND RELIABILITY OF THE TEST INSTRUMENT

Validity

Construct validity has been established for the test instrument by basing the choice of items on discrimination errors, articulation errors, and frequency of consonant sounds of grade one students using research evidence from Miller, Nicely (56), and Templin (70).

Content validity has been established by choosing test items from words of similar frequency. Most of the words were at a primary difficulty level as defined by Lorge-Thorndike (72).

Reliability

After the pilot study was conducted results of the test were subjected to an item analysis computer program, processed by the Division of Educational Research at the University of Alberta. The KR-20 reliability index was .95. This reliability index was obtained from the item analysis conducted in which thirty-two first grade students were used as a test sample. The reliability on the experimental study will be considered in Chapter IV.

Each item was evaluated using the difficulty index, the biserial correlation, and the reliability index. These three

methods of evaluating were the criteria used to determine whether or not an item should remain in the revised test. The difficulty index indicated the proportion of subjects who made a correct response to a particular item. If 30 per cent or more of the examinees did not answer an item correctly, the item did not differentiate well between good and poor auditory discriminators; thus, the particular item was removed from the test (see Figure 1). On the other hand, if 95 per cent of the subjects got an item correct it was also removed on the basis of not differentiating between good and poor discriminators.

Difficulty indices were corrected for chance according to Guilford (34) and an attempt was made to keep items with corrected difficulty indices between .25 and .75. Since a standard number of items was considered desirable for each phonemic contrast, the best three items were retained. Thus some difficulty indices fell outside the desired range.

Biserial correlation is an index of item validity, "the extent to which the given item discriminates among examinees who differ sharply in the function measured by the test as a whole" (30:365). "Biserial correlation gives the correlation of an item with total score on the test" (30:365). Items which fell within the desired difficulty index range were screened according to their biserial correlation. The items with the higher correlations were retained.

A description of the revised form of the Fast-Cosens Auditory Discrimination Test will be submitted in Chapters IV and V.

IX. SUMMARY

This chapter presented a theoretical background on auditory discrimination, showing the relationship between auditory discrimination and articulation of speech sounds. Since oral language and the ability to learn to read are dependent upon speech patterns and auditory discrimination of speech sounds, this chapter has emphasized the significance of speech articulation and auditory discrimination of speech sounds as they relate to reading achievement. An explanation of the construction of the test instrument, as well as an analysis of the Wepman Auditory Discrimination Test have been presented. Then, justification for the choice of items used in the Fast-Cosens Auditory Discrimination Test was discussed. Finally, an explanation of the pilot study, and the reliability and validity of the newly constructed test instrument were presented.

CHAPTER IV

THE EXPERIMENTAL DESIGN

In this chapter the plan of the investigation is discussed under the following headings: the experimental design of the study, the sample, data collection pertinent to the study, and treatment of the data.

I. THE EXPERIMENTAL DESIGN

The data for this study were collected in May, 1968 in Saskatoon. From the thirty-eight public schools with a population of approximately 3,000 first grade students, eight schools were designated by school officials for the purpose of this investigation. Four of these schools were designated as those in a low socio-economic area, and four were designated as being schools in an area other than low. From these 612 students in the eight elementary schools, sixty students were selected from each of the two socio-economic groups to comprise the test sample of 120 students. In order to verify the socio-economic status of each child, the Blishen Occupational Class Scale (6) was utilized by averaging the parent's score of each student.

In order to obtain low and other than low (O.T.L.) reading achievement groups the Monroe New Basic Reading Achievement Tests Pre-Primer and Primer levels plus the general observation made by the classroom teacher were the bases for designating a student as

either a low reading achiever or as one other than low. The Metropolitan Reading Achivement Test, Primary 1, Form B was then administered to verify the reading achievement level of each group.

The cumulative record folders obtained from each school was the source of information on the following data:

1. Sex of the student,
2. Occupation of the father,
3. Scores on the Monroe New Basic Reading Tests,
4. Scores on the Lorge-Thorndike Intelligence Test, Level 1, Form A, Primary Battery,
5. Maico Audiometer scores,
6. The mother's present occupation was also obtained from the cumulative folder, and the mother's previous occupation prior to homemaking was also obtained through telephone calls with the mother.

The Fast-Cosens Auditory Discrimination Test was administered to each student individually by the investigator. All the data were collected by the experimenter, and were analysed using one and two-way analyses of variance, correlations, step-wise linear regression, and a test item analysis of the Fast-Cosens Auditory Discrimination Test.

II. THE SAMPLE

Selection

The test sample of 120 students was selected from the entire population of first grade students in eight public schools in Saskatoon, approximately 3,000 students. Four of these schools were designated by school officials as being in a low socio-economic area, and four were designated as being from an area other than low socio-economic. The total grade one population of these eight schools was 612 students taught by twenty-two teachers. Sixty students of the 316 from the low socio-economic schools, and sixty students of the 296 from the other socio-economic areas were selected using a table of random numbers to comprise the experimental sample. The Blishen Occupational Class Scale (1961) was used to verify the socio-economic status of each child. The socio-economic status score for each student was determined by taking the average score of each student's parents. In cases of only one parent, that parent's score was used. Six students from the L.S.E.S. areas had higher socio-economic status and were replaced with other randomly chosen students. Students from the L.S.E.S. area were equally distributed between classes six and seven on the Blishen Occupational Class Scale, while students from the O.S.E.S. areas represented classes one to five with the majority of students in classes three and four.

The Monroe New Basic Reading Test -- Pre-Primer Level, and the Monroe New Basic Reading Test -- Primer Level, had been administered in the preceding fall to the students by the twenty-two classroom teachers. These tests in conjunction with teacher observations served as a basis for designating students to a low reading achievement group, and to a

group other than low reading achievement.

In order to verify the reading achievement level of each student, another test, the Metropolitan Reading Achievement Test -- Primary 1, Form B, was administered by the investigator in May. This test was given to each of the two groups of sixty students selected randomly from eight different schools who made up the test sample. Those students who achieved a grade level score of 2.00 or less were designated as low reading achievers. Consultation with teachers confirmed these designations of students to reading achievement groups.

As a means of determining that poor auditory discrimination was not due to deficient auditory acuity, a screening test was administered using the Maico Audiometer. This instrument provided for frequency measurements considered vital for oral speech. Any subjects with a hearing loss of 15 decibels according to the American Standards Association (A.S.A.), or 25 decibels according to the International Standards Organization (I.S.O.), or greater, were eliminated from the study and replaced with other randomly selected subjects. Two students were found to have hearing losses greater than 25 decibels according to the International Standards Organization and were thus eliminated from this study. An explanation of the A.S.A. and I.S.O. is given in section three of this chapter.

Sex, Age, and Intelligence of Students in the Test Sample

The distribution of boys and girls in each of the two socio-economic groups and in the two reading achievement groups is illustrated in Table V. The total number of boys in the O.S.E.S. group was thirty-one, with eighteen boys in the low reading

TABLE V

NUMBER AND DISTRIBUTION OF BOYS AND GIRLS IN THE LOW AND OTHER THAN LOW SOCIO-ECONOMIC STATUS GROUPS

Socio-economic Status	Sex	No. of Students	Low Rdg. Achievement	Average Rdg. Achievement
O.S.E.S.	Boys	31	18	13
O.S.E.S.	Girls	29	12	17
Total O.S.E.S.		60	30	30
L.S.E.S.	Boys	28	16	12
	Girls	32	14	18
Total L.S.E.S.		60	30	30
Total S.E.S.	Boys	59	34	25
Total S.E.S.	Girls	61	26	35
Total Sample		120	60	60

achievement group and thirteen boys in the O.T.L. reading achievement group. There were twenty-nine girls in the O.S.E.S. group, with twelve girls in the low reading achievement group and seventeen girls in the O.T.L. reading achievement group. Table V indicates that there are more boys in the low reading achievement group than girls. Likewise, there are more girls in the O.T.L. reading achievement group than boys. The total number of students in the O.S.E.S. group was sixty.

The total number of boys in the L.S.E.S. group was twenty-eight, with sixteen boys in the low reading acheivement group and twelve in the O.T.L. reading achievement group. There was a total of thirty-two girls in the L.S.E.S. group, with fourteen in the low reading achievement group and eighteen in the O.T.L. reading achievement group. The total number of students in the L.S.E.S. group was sixty.

The total number of boys in the entire test sample was fifty-nine, with thirty-four of these in the low reading achievement group, and twenty-five in the O.T.L. reading achievement group. The distribution of girls and boys indicates that there are more boys in the low reading achievement group for both socio-economic status groups. Likewise, there are more girls in the O.T.L. reading achievement group in both socio-economic status groups than boys. Since the test sample was a random sampling of the eight schools involved in the experimental study, it appears that there are more boys with reading problems than girls.

The mean chronological age for the total group was 82.1 months, at the time of collecting the data. The mean chronological age of the four different groups is illustrated in Table VI.

Intelligence quotients were obtained from each subject's cumulative record card on file in each school. The Lorge-Thorndike Intelligence Test, Level I, Form A is a group test that had been administered by the classroom teacher in the fall of the 1967 school term. The mean intelligence score for the total test sample was 107. The mean intelligence quotients for each of the four groups is presented in Table VI.

In each of the socio-economic status groups, the low reading achievers had lower intelligence scores than the O.T.L. reading achievers. The L.S.E.S.-Low Reading Achievers had a mean intelligence score of 101, and the O.S.E.S.-Low Reading Achievers had a mean score of 106. In the O.T.L. reading achievement groups, the L.S.E.S. had a mean intelligence score of 108, and the O.S.E.S. had a mean score of 114. In view of these findings, it appears as though intelligence is related to reading achievement at the first grade level.

It could also be noted that the I.Q. was lower in each L.S.E.S. group than in its O.S.E.S. counterpart.

Summary

From 612 students in eight elementary schools in Saskatoon, 120 students comprised the test sample. These students were chosen

TABLE VI

MEAN GROUP SCORES FOR CHRONOLOGICAL AGE AND INTELLIGENCE OF STUDENTS

Student Groups	Mean Chron. Age in Months	Standard Deviation	Intelligence Quotient	Standard Deviation
L.S.E.S.- L.Rdg.Ach.	82.50	4.99	101	9.33
L.S.E.S.- OTL Rdg.Ach.	81.87	2.99	108	12.25
O.S.E.S.- L.Rdg.Ach.	81.53	3.54	106	11.32
O.S.E.S.- OTL Rdg.Ach.	82.59	4.29	114	11.96
Total Group	82.13	3.90	107	12.12

on the basis of socio-economic status and reading achievement. Sixty students were included in each of the two socio-economic groups (L.S.E.S. and O.S.E.S.). Within each socio-economic group, thirty low reading achievers and thirty other than low reading achievers were randomly selected. Thus, the total test sample was divided into four groups: L.S.E.S.-Low Reading Achievement; L.S.E.S.-O.T.L. Reading Achievement; O.S.E.S.-Low Reading Achievement; and O.S.E.S.-O.T.L. Reading Achievement. The mean chronological age and the intelligence quotients for each of the four groups and for the total test sample were reviewed and illustrated in Table VI. Table V illustrated the number of boys and girls in each socio-economic group, and the number of students in each reading achievement group.

III. DATA COLLECTION PERTINENT TO THE STUDY

Tests, scales, audiometers, and record cards provided the data pertinent to the study.

The Monroe New Basic Reading Test - Pre-Primer level was administered in the fall of the 1967 school term to all grade one students. This was a group test administered by the classroom teacher. The test consisted of seven sub-tests as follows:

1. Understanding sentences,
2. Making inferences,
3. Auditory perception of rhyme,
4. Comprehending thought units,
5. Auditory perception of initial consonants,
6. Recognizing word forms, and
7. Making judgements.

The Monroe New Basic Reading Test - Primer Level was a group test administered after the completion of the Primer book - The New Fun With Dick and Jane. The test was administered to most students in November, 1967. However, in cases in which students had not completed this Basal Reader, the test was given in the spring of 1968. This test has two main sections: Interpretation, and Word Perception. The section on interpretation involves interpretation of sentence and paragraph meaning. The section on word perception involves: visual scrutiny meaning, phonics analysis, and structural analysis. The sub-test on phonics analysis refers to the ability to select the correct picture to complete the sentence with the initial consonant as a cue to select the appropriate answer. The Monroe New Basic Reading Tests are based on the Gage Basal Reading Series and are therefore not a general diagnostic reading test, but merely a test to determine whether or not a student has successfully completed each level of the Gage Reading Series. In view of this, the investigator found it desirable to administer another reading test which was not based on a particular reading series, to determine the reading achievement level of each student in the test sample.

The Metropolitan Reading Achievement Test, Primary 1, Form B, was administered, therefore, by the experimenter in May, 1968 to each of the eight groups of students selected for the test sample from the eight schools involved in this study. Approximately one

and one half hours were required for the administering of this test to each group of the eight groups of students. The test was given in three half-hour sessions, with a recess between each session. The test was marked and recorded by the investigator.

This test has three sub-tests in reading to measure important reading skills. The first sub-test in reading is a thirty-five item test that measures the child's sight vocabulary. "This ability is measured by means of picture vocabulary items in which the child demonstrates his recognition and understanding of the stimulus words by correctly associating each word with a picture" (54:3). The second sub-test is another thirty-five item test in which the child selects an orally presented word from among a group of words of similar configuration. Therefore, success of the test is dependent upon both the auditory and visual discrimination ability of the child.

The third sub-test consists of two parts. First, a thirteen-item section measures the child's ability to comprehend sentences. The child selects from among three sentences the one he thinks describes the picture which is adjacent to the three sentences. The second section consists of thirty-three items and measures the ability to comprehend short stories in paragraph form. Each of the three sub-tests is a timed test and therefore, may affect the final scores of children who are slow readers. This test was a good indication of the achievement level of each subject in

the test sample, as it permitted the evaluation of pupils' achievement in relation to age, and grade scores. Buros (10) indicates that the Metropolitan Reading Achievement Tests are among the best group reading tests available, and that the test appropriately stresses the skills of word picture association, word recognition, and word meaning. He further implies that the chief limitation of the reading material in this test is its concentration on ability to reproduce the factual content of material read.

The Lorge-Thorndike Intelligence Test, Level 1 was administered in September, 1967 to all students in the Saskatoon Public Schools by the classroom teachers. This is a group intelligence test and is strictly a non-verbal test. Buros (9) contends that the Lorge-Thorndike Intelligence Test is among the best group tests available for an intelligence measure. It was administered to students from all socio-economic areas. Buros also suggests that the Lorge-Thorndike I.Q. Test is among the better group instruments available from the statistical viewpoint since it was standardized on 136,000 first grade students upon first entering school in forty-four communities in the United States.

The Fast-Cosens Auditory Discrimination Test prepared by the investigator and a colleague was administered to each child individually. This test attempted to measure the students' ability to discriminate between word pairs which differ only in one sound.

A pilot study was conducted to determine the most discriminable items (see Chapter III). After the pilot study a revised test was prepared. This test consisted of 266 items and the time for administering was 40 minutes. The test was given in two fifteen minute sessions, and one ten minute session. Between each session the student was given a five minute recess. The experimenter recorded the test on a tape recorder in a sound proof room, with four-second intervals between each word pair. Figure 1 illustrates the difficulty index of the initial test and shows the frequency of items retained after the revised test was constructed. The difficulty indices illustrated in Figure 1 are concerned with 'different' word pairs only. The Figure indicates the frequency with which items occurred at the given levels of difficulty. The frequency of items for the test after revision is indicated by the shaded portion on the Figure. The parts on Figure 1, over and above the shaded area indicate the frequency of items occurring within the particular difficulty range before the test was revised. There were 198 'different' word pairs before revision, and 133 items after revisions were made.

The Fast-Cosens Auditory Discrimination Test was presented to each student on a tape recorder. The investigator recorded each child's response on IBM computer score cards and the results were obtained from the optical scorer at the University of Alberta. The complete procedure for administration of the test and a copy of

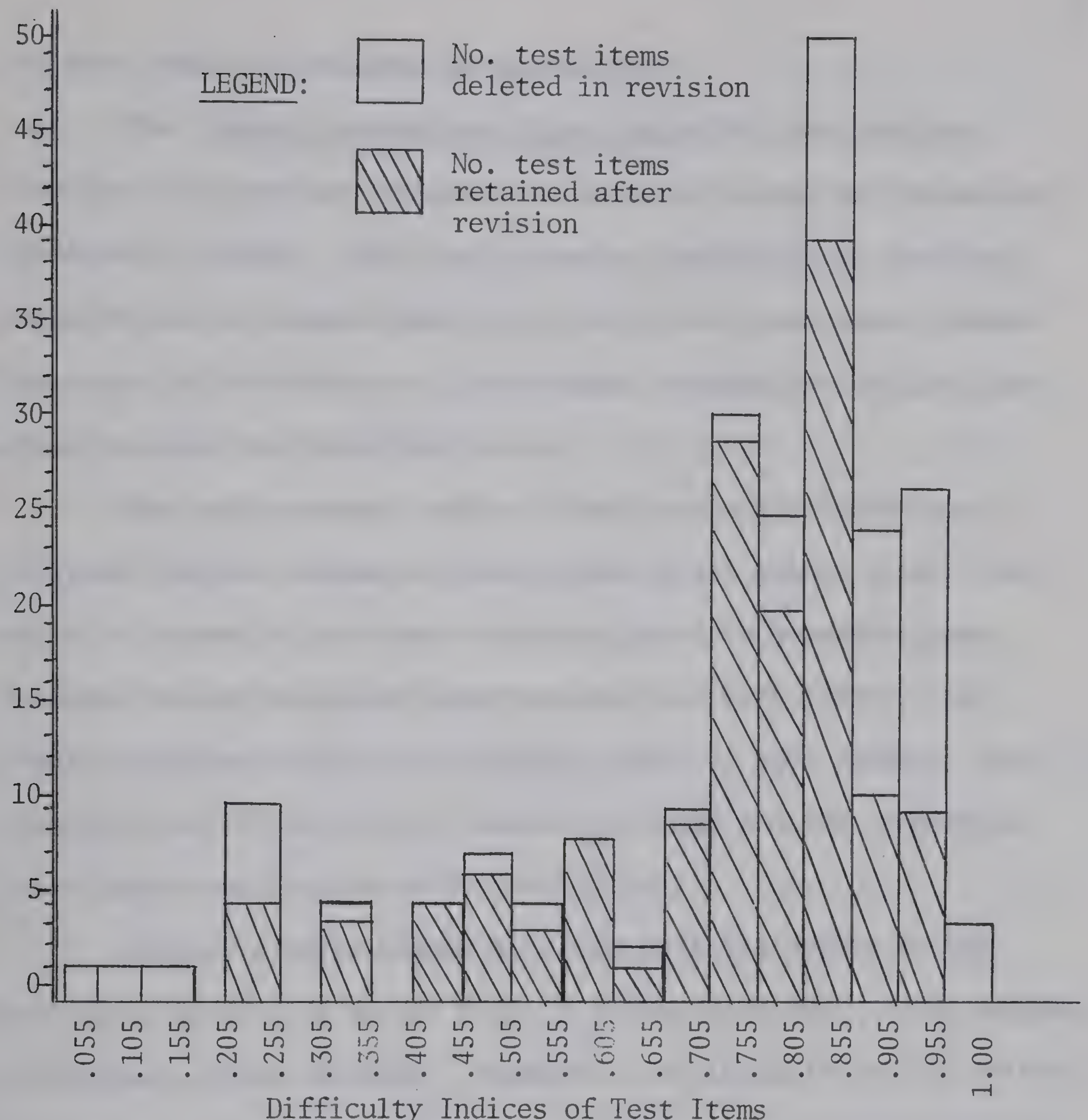

FIGURE 1

TEST ITEMS BEFORE AND AFTER REVISION OF THE

FAST-COSENS AUDITORY DISCRIMINATION TEST

the test itself is included in Appendix A.

The Blishen Occupational Class Scale 1961 was developed from the 1951 Canadian Census of the combined scores for income and education of adults. This scale gives an indication of the class distribution of Canadian adults by placing them into seven classes. Class one included adults of professional occupations, while class seven includes the unskilled laborer.

The socio-economic status of each subject's father was obtained from the cumulative record card in the school files. The mother's present or previous occupation prior to homemaking was obtained through telephone conversations with each mother. In order to determine the socio-economic status of each student, the average score of each child's parents was used and the comparable class number was designated for each child.

Because a child spends more time with his mother during pre-school years, the mother plays in influential part in the language development of her children. Therefore, the inclusion of the mother's occupation in the computation of the child's socio-economic class was warranted because it was assumed that her occupation gave some indication of her own language development which would therefore influence the language performance of her children.

The Maico and Zenith Portable Audiometers were used to test the hearing acuity of each child individually and to determine the hearing loss, if any, of the child. The test was administered in September, 1967, to each child by the school audiologist.

These audiometers consist of portable units equipped with ear phones. Each ear was tested individually. The frequencies measured were: 125, 250, 500, 1000, 1500, 2000, 3000, 4000, 6000, and 8000 cycles per second. The hearing loss dial regulates the intensity of each tone in 5 decibel steps. The decibel levels ranged from 0 decibels which is hearing at an above normal level to 40 decibels at maximum loudness. The child indicated by speaking or nodding his head when the sound was heard. The results for each ear were graphed individually on an audiogram card for each subject.

Broderick and Krantz (8), in an article in Volta Review, compare the new Audiometric Standard Zero Reference as indicated by the International Standards Organization (I.S.O.) to that of the American Standards Association (A.S.A) (see Table VII). In the I.S.A., subjects screened at 25 decibels are considered to have hearing losses which may affect progress in school. This compares to the A.S.A. 15 decibel screening level. The A.S.A. method begins testing at -10 decibels while the I.S.O. starts at 0 decibels. Thus the difference consists of 10 decibels. Table VII shows the association between I.S.O. and A.S.A. It is believed that the International Standards Organization will end the ambiguity and confusion that makes it difficult to make direct comparisons between measurements and studies made in the area of auditory acuity.

Sex and chronological age of each child was obtained from the cumulative record folders as was the socio-economic status of

TABLE VII

A COMPARISON BETWEEN THE INTERNATIONAL STANDARDS ORGANIZATION AND THE AMERICAN STANDARDS ASSOCIATION HEARING LEVELS

Hearing Threshold Level in Decibels	
I.S.O. (1964)	A.S.A. (1951)
0	-10
10	0
25*	15*
30	20
35	25
40	40

*Subjects screened at this level were considered to have hearing losses and were excluded from the present study.

each child's father. The mother's occupation, however, was obtained through telephone conversations. Student scores on the Monroe New Basic Reading Tests, the Lorge-Thorndike Intelligence Test, and on the audiometers were also taken from the cumulative record folders.

IV. TREATMENT OF THE DATA

The raw scores on auditory discrimination and intelligence, as well as the group to which each child was assigned for this study, his sex, and chronological age were punched on data cards and processed by computer programming at the University of Alberta.

Two-Way Analysis of Variance

To test the first hypothesis, that all students regardless of their socio-economic status and their reading achievement, perform equally well on auditory discrimination, two-way analysis of variance was computed. This analysis also determined the interaction between socio-economic status and reading achievement on the criterion variable, auditory discrimination.

One-Way Analysis of Variance

To test the significance of each group performance of students on the auditory discrimination test, one-way analysis of variance was carried out on each of the four groups. The groups were as follows:

1. L.S.E.S. and Reading Achievement,
2. O.S.E.S. and Reading Achievement,
3. Low Reading Achievement,
4. O.T.L. Reading Achievement.

A Newman-Keuls comparison of means for the four groups was completed.

Correlations

Correlation of the Fast-Cosens Auditory Discrimination Test scores with each of the variables: intelligence, chronological age, and sex were computed on each of the following student groups: L.S.E.S.-Low Reading Achievement; L.S.E.S.-O.T.L. Reading Achievement; O.S.E.S.-Low Reading Achievement; O.S.E.S.-O.T.L. Reading Achievement; and the total test sample. These correlations tested the second hypothesis.

Step-wise Linear Regression Analysis

The step-wise regression analysis indicated how well each of the variables: intelligence, chronological age and sex would predict the total score on the Fast-Cosens Auditory Discrimination Test. The step-wise linear regression also indicated the rank order of these predictors.

Item Analysis

Two item analyses of the Fast-Cosens Auditory Discrimination Test were carried out in this study, the first for the pilot study, and the second for the main study. The item analysis conducted for

the pilot study was discussed in Chapter III. The second item analysis included two separate analyses: one for the L.S.E.S. group, and one for the O.S.E.S. group. Each of these permitted a breakdown of the students' performance within each socio-economic group, and also ascertained the reliability of the test instrument.

V. SUMMARY

In this study, the criterion variable was auditory discrimination. The students involved in the test sample were 120 grade one children selected randomly from eight elementary schools in a small Western Canadian City, Saskatoon.

Data were collected by the investigator on the Fast-Cosens Auditory Discrimination Test, and on the Metropolitan Reading Achievement Test. Other data such as: father's occupation, chronological age, intelligence and audiometer scores were obtained from the cumulative record card of each student from the public elementary schools. The socio-economic status score of the parents was taken from the Blishen Occupational Class Scale (6). Showing the significance and the relationship of auditory discrimination to other variables; correlations, step-wise linear regression analysis, one-way analysis, and two-way analysis of variance were used.

CHAPTER V

FINDINGS: THE ANALYSIS OF THE *FAST-COSENS AUDITORY DISCRIMINATION TEST*

The data obtained on the auditory discrimination abilities of 120 grade one students is presented in this chapter in two main sections. First, consideration will be given to the reliability of the *Fast-Cosens Auditory Discrimination Test*, and secondly, the achievement of students on this test will be discussed.

I. RELIABILITY OF THE *FAST-COSENS AUDITORY DISCRIMINATION TEST*

The reliability of the *Fast-Cosens Auditory Discrimination Test* has been established from the results of the pilot study (see Chapter III). Careful consideration was given at that time to each of the test items on the basis of difficulty index, biserial correlation, and the reliability index. The number of test items retained for the main study was 266.

In order to obtain an item analysis the test was divided into two parts to accommodate computer facilities. Part one consisted of the first 140 test items while part two consisted of the remaining 126 test items. Table VIII presents the KR-20 reliability indices of both parts for each of the socio-economic groups.

The reliability indices for the L.S.E.S.was slightly higher than for the O.S.E.S. group. The reliability for the L.S.E.S. was

TABLE VIII

RELIABILITY OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

FOR THE L.S.E.S. AND THE O.S.E.S. GROUPS

Student Groups	KR-20 Reliability	
	Part 1 of Test	Part 2 of Test
L.S.E.S. N = 60	.90	.89
O.S.E.S. N = 60	.82	.87

.90 and .89 as compared to the O.S.E.S. of .82 and .87. Considering its totality, the test was satisfactorily reliable.

When comparing the reliability of the revised Fast-Cosens Auditory Discrimination Test to that of the initial test, it should be noted that the reliability of the initial test was .94 and .96 respectively. The initial test was administered to a random stratified sample of thirty-two students, fifteen students from a L.S.E.S. area and seventeen students from an O.S.E.S. area. Since the first test item analysis was computed on a test sample of only thirty-two students, and since this was a cross-section of the population rather than an item analysis of each specific socio-economic group of children, some of the variance between the KR-20 reliability indexes of the pilot study and of the experimental study may be accounted for.

II. STUDENT ACHIEVEMENT ON THE FAST-COSENS AUDITORY DISCRIMINATION TEST

General Performance of Student Groups

The results of the Fast-Cosens Auditory Discrimination Test revealed that on the whole the O.S.E.S. group performed much better on each item than did the L.S.E.S. group. However, in five isolated instances the L.S.E.S. group performed somewhat better than the O.S.E.S. group. In these five instances the items appeared to be difficult for all students and thus, it could be that some children

resorted to guessing with the L.S.E.S. group the better guessers. It could also be that the L.S.E.S. group do have better discrimination in these sounds.

Table IX presents the test means of each of the two socio-economic groups on the Fast-Cosens Auditory Discrimination Test. The total possible test score was 266. The mean score for the L.S.E.S. group was 206.38 while the test mean for the O.S.E.S. group proved to be considerably higher with a mean of 226.40. The level of the performance of students as represented by these test means cannot be definitively assessed. Both groups could improve their auditory discrimination.

When considering performance of student socio-economic status groups on the Fast-Cosens Auditory Discrimination Test by reading achievement, it was established that students in the O.T.L. reading achievement groups performed significantly higher on auditory discrimination scores than did students in the low reading achievement groups. The L.S.E.S.-O.T.L. Reading Achievement group obtained a mean score of 215.46 as compared to a mean score of 199.53 for the L.S.E.S.-Low Reading Achievement group. In the O.S.E.S. groups, the O.T.L. reading achievers obtained a mean score of 237.23 as compared to 220.36 in the O.S.E.S. Low Reading Achievers.

A further observation as indicated on Table X was that both the low and O.T.L. readers in the O.S.E.S. group obtained higher

TABLE IX

PERFORMANCE OF STUDENT SOCIO-ECONOMIC STATUS GROUPS ON

THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Stud. Socio-Econ. Status Group	No. Studs. in Group	Test Means ($\frac{266}{266}$) Part 1 140/140	Test Means Part 2 126/126	Test Variance Part 1	Test Variance Part 2	Achievement Groups (N = 12 approx. Name	PART 1 Range of marks	PART 1 Range of scores 140/140	PART 2 Range of marks	PART 2 Range of scores 126/126
L.S.E.S.	60	111.63	94.75	157.40	158.09	Upper 5	9	123-132	13	106-119
						Upper 4	5	117-122	6	99-105
		(206.38)				Upper 3	6	110-116	4	94- 98
						Upper 2	4	105-109	5	88- 93
						Upper 1	33	71-104	31	56- 87
O.S.E.S.	60	120.52	105.88	68.15	87.77	Upper 5	5	128-133	6	116-122
						Upper 4	2	125-127	4	111-115
		(226.40)				Upper 3	4	120-124	6	104-110
						Upper 2	5	114-119	6	97-103
						Upper 1	13	97-110	12	84 - 96

TABLE X

PERFORMANCE OF STUDENT SOCIO-ECONOMIC STATUS GROUPS ON FAST-COSENS AUDITORY DISCRIMINATION TEST BY READING ACHIEVEMENT

Student Group	No. of Students in Group	Test Mean (266/266)	S.D.
1. L.S.E.S.- Low Rdg.	30	199.53	27.26
2. O.S.E.S.- Low Rdg.	30	220.36	14.36
3. L.S.E.S.- O.T.L. Rdg.	30	215.46	19.22
4. O.S.E.S.- O.T.L. Rdg.	30	237.23	9.68
5. Total Sample	120	218.15	22.95

test mean scores than either the low or O.T.L. readers in the L.S.E.S. group. This information is a good indication that L.S.E.S. children have not developed their auditory discrimination abilities to the same extent as O.S.E.S. children. The student performance on auditory discrimination may therefore be an influential factor in success in reading achievement of young students.

From the analysis of the test results it was revealed that the test mean of the O.S.E.S. group was 207.50 or 86 per cent as compared with 228.80 or 78 per cent by the L.S.E.S. group. It would appear that this differential of 21.30 or 8 percent scored by the two socio-economic groups, could serve to indicate the adequacy or inadequacy of auditory discrimination and thereby serve as an indication of success in reading achievement.

Performance of Students by Achievement Levels

The test item analysis revealed the achievement level of student performance by distributing the students into five achievement groups, with approximately twelve students or 20 per cent of the students in each group. Table IX illustrates the range of scores within each of the five achievement groups for each socio-economic status group. For the L.S.E.S. group the range of scores on part one was from 71 to 132, out of a possible 140. In the O.S.E.S. group the scores on part one ranged from 97 to 133. Out of a total possible range of 126 scores on part 2 of the Fast-

Cosens Auditory Discrimination Test, the L.S.E.S. scores ranged from 56 to 119, while the O.S.E.S. scores ranged from 84 to 122. The fact that the range of scores is much more varied in the L.S.E.S. group than the O.S.E.S. group would verify that the test variance for the L.S.E.S. is much higher than the O.S.E.S. group. Table IX indicates the test variance of each of parts one and two for each of the two socio-economic groups.

A further analysis of each of the five achievement groups on the Fast-Cosens Auditory Discrimination Test indicates a relatively consistent range of marks between parts one and two for each socio-economic group (see Table IX). The range of marks in the L.S.E.S. group tends to be greater than for the O.S.E.S. group. In the L.S.E.S. group, part one of the test, the range of marks in the lowest 20 per cent of children has a range of thirty-three, while part two has a range of thirty-one. In the O.S.E.S. group the range of marks in the bottom 20 per cent of students is thirteen and twelve in parts one and two respectively. Again, this indicates a much greater variance among the marks of the L.S.E.S. students. Since approximately 20 per cent of the students are in each of the five ability ranges, there is strong evidence that the L.S.E.S. students are poorer discriminators of minimal word pairs than the O.S.E.S. children. This is especially noticeable in the lower achievement groups.

Performance of Students By Types of Sounds and Their Numbers

The types and number of sounds compared on the Fast-Cosens Auditory Discrimination Test is illustrated in Table XI. The mean difficulty index for each socio-economic group, the difference between means, and the percentage of differences between means are also presented in the same table. The types of items most easily discriminated by students of both socio-economic groups were the glides and the lateral. Eleven different word pairs were presented in the glides and lateral categories. Of these, 86 per cent of the students in the O.S.E.S. group and 73 per cent of the students in the L.S.E.S. group answered items correctly. Since students generally find word pairs in the initial position the least difficult to distinguish, it is possible that the glides and the lateral /1/, were found to be easy items since most of these comparisons were made in the initial position. Items in the final position tended to cause the most difficulty for children in the test sample. There were no glide or lateral comparisons in the final position, since it is not possible to make minimal word pairs in the final position with the glides.

In order to determine the specific trouble spots in auditory discrimination of speech sounds of children, consideration was given to the degrees of difficulty and the types of difficulty experienced.

The difficulty index level for each sound comparison and the average difficulty index of each group of sound comparisons is

TABLE XI

DIFFICULTY LEVELS OF STUDENT SOCIO-ECONOMIC STATUS GROUPS OF TYPES OF SOUNDS

TESTED ON THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Type of Sound	No. of Test Items	Socio-Econ. Status Groups	No. of Test Items in Difficulty Ranges 8.5-1.00	7.5-8.4	0-7.4	Mean Difficulty Index Level of the Test Items	Difference Between Means	% of Differences Between Means
Stops	24	L.S.E.S. O.S.E.S.	1 7	1 8	22 9	.601 .757	.156	16
Nasals	11	L.S.E.S. O.S.E.S.	- 5	- 3	11 3	.582* .750*	.168	17
Glides with Lateral	11	L.S.E.S. O.S.E.S.	- 8	5 2	6 1	.727** .859**	.132	13
Frica-tives	48	L.S.E.S. O.S.E.S.	9 32	15 8	24 8	.689 .801	.112	11
Affri-cates	16	L.S.E.S. O.S.E.S.	1 6	4 5	11 5	.644 .760	.116	12
Stops with Fricatives	23	L.S.E.S. O.S.E.S.	3 10	6 6	14 7	.654 .751	.097	10

*Most difficult type of item.

**Easiest type of item.

presented in Appendix B with a summary presented in Tables XV and XVI. The degrees of difficulty were divided into three groups for each socio-economic status, from the least difficult to the most difficult items. The easiest items were those in which 85 to 100 per cent of the test population received the correct answers, with the difficulty indices between .85 to 1.00. The middle category consisted of those items in which 75 to 84 per cent of the students received the correct answer, with the difficult indices between .75 and .84 inclusive. The most difficult items were those in which less than 75 per cent of the students received the correct answers. The categories were determined on the basis of difficulty encountered for the O.S.E.S. group. By comparing the performance of the two groups, the greater number of items falling in the most difficult range in the L.S.E.S. group is in striking contrast.

Types of Sounds

As a group, the nasals tended to give first grade students the most difficulty. In the nasal category, 75 per cent of the O.S.E.S. group and 58 per cent of the L.S.E.S. students answered items correctly. The difference between the two groups was 17 per cent in favor of the O.S.E.S. group. In relation to the overall performance on the Fast-Cosens Auditory Discrimination Test, the L.S.E.S. group performance fell 20 per cent below the overall test norm of 78 per cent and the O.S.E.S. group performance fell 11 per

cent below the overall test norm of 86 per cent. This indicates that more attention should be given to the teaching of nasals in the first school year. In every type of sound comparison, the O.S.E.S. students' performance was superior to the L.S.E.S. students, with the difference ranging from 10 to 17 per cent. These findings suggest that perhaps both quality and quantity of speech is lacking in lower class homes, and that sounds are probably less carefully articulated in these homes.

Voicing

When consideration was given to voicing, it was found that the voiceless fricatives were the most easily discriminated by both socio-economic groups, as indicated on Table XII. The O.S.E.S. had a mean difficulty index level of .822 or 82 per cent, while the L.S.E.S. group received a mean difficulty index level of .732 or 73 per cent. These findings compare favorably with the mean overall performance of each socio-economic group on the Fast-Cosens Auditory Discrimination Test. This is an interesting finding, since most authorities in auditory discrimination seem to agree that the high frequency sounds are the most difficult for the students to distinguish. It would be interesting to know whether the sound frequency ranges of voiceless fricatives have greater spread than the voiced fricatives. If so, perhaps the reason students can discriminate among the voiceless fricatives more easily may be due to this greater spread in the frequency ranges of these sounds.

TABLE XII

DIFFICULTY LEVELS OF STUDENT SOCIO-ECONOMIC STATUS GROUPS ON TYPES OF VOICED AND VOICELESS SOUNDS OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Type of Sound	Voicing	No. of Items	Socio-Econ. Status Groups	No. of Test Items in Difficulty Ranges 8.5-1.00	7.5-8.4	0-7.4	Mean Difficulty Index Level of the Test Items	Difference Between Means	% of Difference Between Means
Stops	voiced	9	L.S.E.S.	1	1	7	.599	.169	17
			O.S.E.S.	3	2	4	.767		
	voiceless	15	L.S.E.S.	-	-	15	.602	.149	15
			O.S.E.S.	4	6	5	.751		
Fricatives	voiced	13	L.S.E.S.	1	1	11	.569*	.175	18
			O.S.E.S.	7	3	3	.744*		
	voiceless		L.S.E.S.	8	14	13	.732**	.90	9
			O.S.E.S.	25	5	5	.822**		

*Most difficult group of items

**Easiest group of items.

The most difficult items in voicing as a group, were the voiced fricatives in which 74 per cent and 57 per cent of the students in the O.S.E.S. and L.S.E.S. groups respectively, answered items correctly. In these instances, eleven of the thirteen items compared in the L.S.E.S. group fell in the most difficult range, whereas in the O.S.E.S. group, only three comparisons fell in the most difficult range. That is to say, in both groups, the auditory discrimination achievement level was well below the overall achievement levels of 86 per cent and 78 per cent respectively. The differences of 21 per cent in respect to the L.S.E.S. group performance and of 12 per cent in the O.S.E.S. group performance show, in each case, a one per cent greater difficulty experienced with the voiced fricatives as opposed to the nasals.

The most difficult single item was the /v/-/ð/ comparison in the final position (see Appendix B). This finding corroborates with Miller and Nicely's (56) findings in which they indicate that /v/-/ð/ are among the most difficult to discriminate. Perhaps this comparison is more difficult than other voiced fricative comparisons because both sounds are articulated in the front position of the mouth and therefore the frequency sound or pitch may be more similar than other comparisons such as /v/-/z/. The difficulty index level of the voiced and voiceless stops were similar to those of the voiced and voiceless fricatives as indicated in Table XII. Again the O.S.E.S. group performed considerably better on all types of sounds

involving voicing than did the L.S.E.S. group. The percentage of difference between the two groups ranged from 9 to 18 per cent.

Position of Sound

Next, consideration was given to the position of each type of sound. Table XIII illustrates the number of items compared, the number of test items in each difficulty range, the difficulty index level of each socio-economic group, and the percentage of differences between the two socio-economic groups in each sound position. Of the six different types of sounds included in the Fast-Cosens Auditory Discrimination Test, the initial, medial, and final positions were included wherever possible. Fourteen different groups of items are shown in Table XIII for each socio-economic group. The three least difficult items for the O.S.E.S. group were the nasals in the final position, the glides and lateral /l/ in the initial position, and the fricatives in the medial position. In the nasals final position, 86 per cent of the sixty students in the O.S.E.S. group received the correct answer. Similarly, 86 per cent answered the glides and lateral /l/, in the initial position correctly, and 87 per cent of the students received correct answers on items consisting of fricatives in the medial position. These results indicate that in these particular sounds, children from the O.S.E.S. group performed at the overall test mean. It would appear that training in these sounds need not be stressed beyond the scope of the regular language arts program. Students from the

TABLE XIII

DIFFICULTY LEVELS OF STUDENT SOCIO-ECONOMIC STATUS GROUPS ON

POSITION OF SOUNDS OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Position	Sound Type	No. of Items	Socio-Econ. Status Groups	No. of Test Items in Difficulty Ranges 8.5-1.00	7.5-8.4	0-7.4	Mean Difficulty Index Level of the Test Items	Differences Between Means of L.S.E.S.&O.S.E.S.	Differences in % Between Means of L.S.E.S.&O.S.E.S.
Initial	Stops	-	L.S.E.S. O.S.E.S.	- -	- -	- -	- -	- -	- -
	Nasals	-	L.S.E.S. O.S.E.S.	- -	- -	- -	- -	- -	- -
	Glides with Lateral	9	L.S.E.S. O.S.E.S.	- 7	4 1	5 1	.730** .861**	.131	13
	Frica-tives	15	L.S.E.S. O.S.E.S.	2 6	4 5	9 4	.644* .695	.031	3
	Affri-cates	3	L.S.E.S. O.S.E.S.	- -	- 1	3 2	.517* .661*	.144	14
	Stops with Frica-tives	12	L.S.E.S. O.S.E.S.	3 7	3 2	6 3	.687 .785	.98	10
Medial	Stops	6	L.S.E.S. O.S.E.S.	- 2	- 3	6 1	.647 .817	.170	17

TABLE XIII (continued)

Medial	Nasals	5	L.S.E.S.	-	-	5	.593	.200	20
			O.S.E.S.	2	2	1	.793		
	Glides with Lateral	2	L.S.E.S.	-	1	1	.716**	.136	14
			O.S.E.S.	1	1	-	.852		
	Frica-tives	13	L.S.E.S.	3	5	5	.741**	.133	13
			O.S.E.S.	11	2	-	.874**		
	Affri-cates	7	L.S.E.S.	1	3	3	.678	.074	7
			O.S.E.S.	3	1	3	.752		
	Stops with Frica-tives	-	L.S.E.S.	-	-	-	-	-	-
			O.S.E.S.	-	-	-	-	-	-
Final	Stops	18	L.S.E.S.	1	1	16	.584*	.151	15
			O.S.E.S.	4	7	7	.735*		
	Nasals	6	L.S.E.S.	-	-	6	.572*	.289	29
			O.S.E.S.	3	1	2	.861**		
	Glides with Lateral	-	L.S.E.S.	-	-	-	-	-	-
			O.S.E.S.	-	-	-	-	-	-
	Frica-tives	20	L.S.E.S.	4	6	10	.671	.124	12
			O.S.E.S.	15	1	4	.795		
	Affri-cates	6	L.S.E.S.	-	1	5	.667	.172	17
			O.S.E.S.	3	3	-	.839		

TABLE XIII (continued)

Final	Stops with Frica-tives	11	L.S.E.S. O.S.E.S.	- 3	3 4	8 4	.617 .760	.143	14
Total		133						.134	13.4

*The three hardest groups of items.

**The three easiest groups of items.

L.S.E.S. group found glides with the lateral /l/ in the initial and medial positions, as well as the fricatives in the medial position, the easiest to discriminate. The difficulty indices for these positions which were .730, .716, and .741 respectively indicate that position of sounds for the L.S.E.S. group presents an area of difficulty since these were the least difficult items when position of sounds was considered. In each case the O.S.E.S. group performance was higher than the L.S.E.S. group.

Table XIII also illustrates the most difficult items for each of the two socio-economic groups. The O.S.E.S. group found stops in the final position, fricatives in the initial position, and affricates in the initial position the most difficult items to discriminate. The mean difficulty indices for each of these three positions were: .735, .695, and .661 respectively. The L.S.E.S. group also found the stops in the final position and the affricates in the initial position the most difficult items, with mean difficulty indices of .584 and .517 respectively. In addition, the L.S.E.S. group found the nasals in the final position a very difficult item with a difficulty index of .572. In each of the socio-economic groups, the difficulty indices for these items fell below the mean difficulty index of the overall test. Thus it appears that not only is a particular type of sound or position of sound an area of difficulty for students, but the particular combination of type, position, and voicing does contribute to the discriminability of the items compared.

Since stops are produced in such a way that the air flow is stopped or obstructed during articulation, it could be, that since the air flow of the final stops is stopped more abruptly than in the other positions, that childrens' discrimination are not highly enough developed to differentiate between sounds that end so promptly. The most difficult comparison of stops was the /p/-/k/ in the final position in which 45 per cent of the L.S.E.S. group and 57 per cent of the O.S.E.S. group obtained correct answers.

The L.S.E.S. group as well as the O.S.E.S. group found the fricatives in the initial position a difficult group of items with an average difficulty index of .644 for the L.S.E.S. group, and .695 for the O.S.E.S. group. In the voiceless fricatives the item which contributed most to the lowering of the average difficulty index for each socio-economic group was the /θ/-/f/ which obtained an average score of .416 and .455 for the L.S.E.S. and the O.S.E.S. groups respectively.

Although the affricates in the initial position was one of the most difficult items when position was considered, these findings should be held tentative since only three comparisons of affricates in the initial position were made.

It appears that the vowel sound which follows the consonant being compared, may affect the degree to which the comparison is distinguished by students. For example, 'sheep-cheap' appears to be much more difficult to discriminate than 'lash-latch'. Thus it

seems that the environment of the phonemes compared play an important part in so far as the discriminability of word pairs is concerned.

Whereas the O.S.E.S. group found the nasals in the final position a relatively easy set of items, the L.S.E.S. group found the nasals in the final position difficult. The degree of difficulty was .572 as compared to .861 for the O.S.E.S. group. The difference between means of the two groups was 29 per cent. When considering all comparisons on position of sound, the difference between means on the L.S.E.S. and the O.S.E.S. groups ranged from 3 to 29 per cent, with the average percentage of difference at 13.4 per cent in favor of the O.S.E.S. group.

A further analysis of position of sounds with consideration given to voicing is presented in Table XIV. Results from data in Table XIII emphasized that the fricatives in the medial position were the easiest to discriminate for first grade students. This finding is further supported from data in Table XIII in which the voiceless fricatives in the medial position were the least difficult word pairs for first grade students to discriminate. The total number of comparisons made in the voiceless fricatives medial positions was eight, with the mean difficulty index level of .883 for the O.S.E.S. group, as compared to .821 for the L.S.E.S. group. Thus the voiceless fricatives in the medial position presented least difficulty for the students in the test sample. The mean

TABLE XIV

DIFFICULTY LEVELS OF STUDENT SOCIO-ECONOMIC STATUS GROUPS ON VOICED AND VOICELESS SOUNDS WHEN POSITION OF SOUND IS CONSIDERED ON THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Voicing	Position of Sound	Type of Sound	No. of Items	Socio-Econ. Status Groups	No. of Test Items in Difficulty Ranges 8.5-1.00	7.5-8.4	0-7.4	Mean Difficulty Index Level of the Test Items	Difference Between Means	% of Difference Between Means
Voiced	Initial	Stops	-	L.S.E.S.	-	-	-	-	-	-
				O.S.E.S.	-	-	-	-	-	-
	Medial	Stops	-	L.S.E.S.	-	-	-	-	-	-
				O.S.E.S.	-	-	-	-	-	-
	Final	Stops	-	L.S.E.S.	1	1	7	.572	.136	17
				O.S.E.S.	2	4	3	.708		
Voice-less	Initial	Stops	-	L.S.E.S.	-	-	-	-	-	-
				O.S.E.S.	-	-	-	-	-	-
	Medial	Stops	6	L.S.E.S.	-	-	6	.647	.170	17
				O.S.E.S.	2	3	1	.817		
	Final	Stops	9	L.S.E.S.	-	-	9	.572	.136	14
				O.S.E.S.	2	3	4	.708		
Voiced	Initial	Frica-tives	3	L.S.E.S.	-	-	3	.627	.100	10
				O.S.E.S.	-	2	1	.728		
	Medial	Frica-tives	5	L.S.E.S.	-	1	4	.613	.240	24
				O.S.E.S.	4	1	-	.853		

TABLE XIV (continued)

Voiced	Final	Fricatives	5	L.S.E.S.	1	-	4	.490*	.153	15
				O.S.E.S.	3	-	2	.643*		
Voiceless	Initial	Fricative	12	L.S.E.S.	2	4	6	.674	.74	7
				O.S.E.S.	6	3	3	.748		
	Medial	Fricative	8	L.S.E.S.	3	4	1	.821**	.67	7
				O.S.E.S.	7	1	-	.888**		
	Final	Fricative	15	L.S.E.S.	3	3	9	.732	.114	11
				O.S.E.S.	12	1	2	.846		

*Hardest group of items.

**Easiest group of items.

difficulty index for each socio-economic group exceeded the overall test mean of each socio-economic group. These findings indicate that voiceless fricatives in the medial position are easily distinguished and therefore need not be emphasized in an auditory training program.

It was further established that the voiced fricatives in the final position were the most difficult items for students from each socio-economic group. The mean difficulty index level for the O.S.E.S. group was .643 and for the L.S.E.S. group .490. The most difficult item on the entire test was the voiced fricative comparison in the final position of the sounds /v/ with /ð/. This comparison secured a mean difficulty index score of .242 for the O.S.E.S. group, and .175 for the L.S.E.S. group. This contrast strongly influences the mean difficulty index for the entire set of voiced fricatives in the final position. These findings support Miller and Nicely's conclusions (56) that /v/-/ð/ are among the most difficult items to discriminate. It could be that since /ð/ is infrequently used in the final position, and first grade students would not have had sufficient experience with this sound in the final position, that they, therefore, cannot differentiate between /v/-/ð/. The /v/ sound, on the other hand, is one of the five sounds that comprises more than 50 per cent of the final consonants in the English language (55:87). Therefore, additional emphasis should be placed upon these sounds when instructing first grade students.

Table XIV also presents the number of items in each comparison, the number of items in each of three difficulty ranges, the difference between the means of the two socio-economic groups, and the percentage of difference between the groups. Again, the O.S.E.S. group performance was superior to the L.S.E.S. group on the Fast-Cosens Auditory Discrimination Test, with the percentage of difference ranging from 7 to 24 per cent in favor of the O.S.E.S.

It should also be noted that both the voiced and voiceless stops in the final position were difficult items to distinguish, particularly for the L.S.E.S. group. Out of nine voiced final stop comparisons seven of these were in the most difficult range of difficulty for the L.S.E.S. group. In the voiceless final stops, all nine comparisons fell into the most difficult range. This implies that less than 75 per cent of the children in the L.S.E.S. group received correct answers on these comparisons.

Finally, an analysis of each group of word pairs on the Fast-Cosens Auditory Discrimination Test was considered to determine the specific sounds which caused each of the two socio-economic groups the most difficulty, as well as those sounds which presented the least difficulty. Table XV presents the mean difficulty index for each group of sound comparisons, the percentage of difficulty for each comparison on both socio-economic status groups, and the percentage of difference between the two groups.

TABLE XV

MEAN DIFFICULTY INDEX LEVEL, PERCENTAGE OF DIFFICULTY, AND PERCENTAGE OF DIFFERENCE BETWEEN SOCIO-ECONOMIC STATUS GROUPS FOR EACH GROUP OF SOUND COMPARISONS ON THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Type of Sound	No. of Items	Mean Diff. Index, OSES.	% of Diff. on OSES.	Mean Diff. Index, LSES.	% of Diff. on LSES	Difference between SES in %
STOPS voiceless						
p-t (medial)	3	.856	86.*	.617	62.	24.
p-t (final)	3	.733	73.	.583	58.	15.
p-k (final)	3	.567	57*	.450	45.*	12.
t-k (medial)	3	.778	78.	.678	68.	10.
t-k (final)	3	.823	82.	.683	68.	14.
STOPS voiced						
d-g (final)	3	.825	83.	.725	72.	11.
b-g (final)	3	.639	64*	.422	42.*	22.
d-b (final)	3	.856	86.	.689	69.	17.

TABLE XV (continued)

NASALS						
n-ŋ (medial)	2	.775	76.	.508	51.*	25.
n-ŋ (final)	3	.644	64.*	.517	52.*	12
m-ŋ (medial)	3	.805	81.	.650	65.	17.
m-ŋ (final)	3	.783	78.	.629	63.	15.
GLIDES						
l-r (initial)	3	.884	88.**	.711	71.	17.
l-r (medial)	2	.850	85.	.716	72.	13.
w-l (initial)	3	.861	86.	.744	74.	12.
w-r (initial)	3	.839	84.	.734	73.	11.
FRICATIVE voiced						
v-ð (initial)	3	.728	73.*	.627	63.	10.
v-ð (final)	3	.242	24.*	.175	18.*	6.
z-ð (medial)	3	.844	84.	.539	54.*	30.
v-z (medial)	2	.866	87.	.725	73.	14.
v-z (final)	3	.911	91.**	.700	70.	21.
FRICATIVES voiceless						
θ-f (initial)	3	.455	46.*	.416	42.*	4.
θ-s (initial)	3	.889	89.**	.700	70.	19.
θ-s (final)	3	.833	83.	.720	72.	11.

TABLE XV (continued)

FRICATIVES voiceless						
s-f (medial)	3	.850	85.	.828	83.**	2.
s-f (final)	3	.911	91.**	.761	76.**	15.
š-s (initial)	3	.844	84.	.789	79.**	5.
š-s (medial)	3	.900	90.**	.775	78.**	12.
š-s (final)	3	.689	69.*	.572	57.	12.
š-θ (initial)	3	.805	81.	.789	79.**	8.
š-θ (final)	3	.895	90.**	.828	83.**	12.
š-f (medial)	3	.917	92.**	.844	84.**	8.
š-f (final)	3	.900	90.**	.778	78.**	12.
AFFRICATES						
š-č (initial)	3	.661	66.*	.517	52.*	14.
š-č (medial)	3	.795	80.	.583	58.	22.
š-č (final)	3	.867	87.	.700	70.	17.
ǰ-z (medial)	2	.917	92.**	.817	82.**	10.
ǰ-z (final)	3	.811	81.	.667	67.	14.
ǰ-ž (medial)	2	.467	47.*	.434	43.*	4.

TABLE XV (continued)

vl STOPS with voiceless frica-tives						
p-f (final)	3	.783	78.	.650	65.	13.
p-θ (initial)	3	.900	90.**	.861	86.**	4.
p-θ (final)	3	.589	59.*	.489	49.*	10.
voiced STOPS with voiced fricatives						
v-b (initial)	3	.566	57.*	.472	47.*	10.
ð-b (initial)	3	.756	76.	.633	63.	13.
z-d (final)	3	.928	93.**	.789	79.**	14.
d-ð (initial)	3	.917	92.**	.783	78.**	14.
d-ð (final)	3	.750	75.	.550	55.*	20

*Lowest 10% of correct items - range OSES 75% of students answered correctly.
- range LSES 56% of students answered correctly.

**Highest 10% of correct items - range OSES 88% of students answered correctly.
- range LSES 76% of students answered correctly.

Least Difficult Test Items - O.S.E.S. Students

The highest 10 per cent of items found to contribute least difficulty for students in the O.S.E.S. group were those in which 88 per cent or more of the students answered word pairs correctly. Those items contributing to the best 10 per cent of items for the O.S.E.S. group were as follows:

*Voiced stop with voiced fricative /z/-/d/ in the final position.	93%
*Voiced stop with voiced fricative /d/-/ð/ in the initial position.	92%
*Affricate /j/ with fricative /z/ in the medial position.	92%
*Voiceless fricative /š/-/f/ in the medial position.	92%
*Voiceless fricatives /s/-/f/ in the final position.	91%
Voiced fricatives /v/-/z/ in the final position.	91%
*Voiceless fricatives /š/-/s/ in the medial position.	90%
*Voiceless fricatives /š/-/θ/ in the final position.	90%
*Voiceless fricatives /š/-/f/ in the final position.	90%
*Voiceless stop with voiceless fricative /p/-/θ/ in the initial position.	90%
Voiceless fricatives /s/-/θ/ in the initial position.	89%
Lateral /l/ with the glide /r/ in the initial position.	88%

Least Difficult Test Items - L.S.E.S. Students

The highest 10 per cent of items found to contribute least difficulty for the sixty students in the L.S.E.S. group were those

in which 76 per cent of the students answered the word pairs correctly. The 10 per cent of items which were most easily discriminated by students in the L.S.E.S. group were as follows:

*Voiceless stop with voiceless fricative /p/-/θ/ in the initial position.	86%
*Voiceless fricatives /š/-/f/ in the medial position.	84%
*Voiceless fricatives /š/-/θ/ in the final position.	83%
Voiceless fricatives /s/-/f/ in the medial position.	83%
*Affricate /j/ with fricative /z/ in the medial position.	82%
Voiceless fricatives /š/-/s/ in the initial position.	79%
Voiceless fricatives /š/-/θ/ in the initial position.	79%
*Voiced stop with voiced fricative /z/-/d/ in the final position.	79%
*Voiced stop with voiced fricative /d/-/ð/ in the initial position.	78%
*Voiceless fricative /š/-/s/ in the medial position.	78%
*Voiceless fricatives /š/-/f/ in the final position.	78%
*Voiceless fricatives /s/-/f/ in the final position.	76%

Those comparisons marked with one asterisk in the lists of the least difficult test items are the nine items which are common to both the L.S.E.S. group and the O.S.E.S. group. Out of the 10 per cent of items, that is, twelve items, which contributed least difficulty for the O.S.E.S. group eleven of these included fricatives, and one was the lateral /l/ and glide /r/ comparison. For the

L.S.E.S. group, all twelve items included fricatives. Furthermore, seven and nine of the O.S.E.S. and L.S.E.S. groups respectively consisted of voiceless sounds. For the O.S.E.S. group four of the twelve easiest items were in the initial position, two in the medial position and six in the final position. For the L.S.E.S. group, four were in the initial position, four in the medial and four in the final position. Table XVI illustrates the types and positions of both the twelve least difficult and the twelve most difficult items for each socio-economic group.

Most Difficult Test Items - O.S.E.S. Students

The 10 per cent of items which students in the O.S.E.S. group experienced most difficulty were those items in which fewer than 75 per cent of the students answered the word pairs correctly. These items are presented as follows:

*Voiced fricatives /v/-/ʒ/ in the final position.	24%
*Voiceless fricatives /θ/-/f/ in the initial position.	46%
*Affricate /ǰ/ with fricative /ž/ in the medial position.	47%
*Voiced stop /b/ with voiced fricative /v/ in the initial position.	57%
*Voiceless stops /p/-/k/ in the final position.	57%
*Voiceless stop with voiceless fricative /p/-/θ/ in the final position.	59%
*Voiced stops /b/-/g/ in the final position.	64%
*Nasals /n/-/ŋ/ in the final position.	64%

TABLE XVI

THE 10 PER CENT OF THE LEAST DIFFICULT AND

THE 10 PER CENT OF THE MOST DIFFICULT SOUNDS

EXPERIENCED BY THE L.S.E.S. AND THE O.S.E.S. GROUPS

Levels of Difficulty	No of Items	No.	O.S.E.S. Type of Sound	No.	L.S.E.S. Type of Sound
Least Difficult	12	11	fricatives	12	fricatives
		1	lateral	0	lateral
		7	voiceless sounds	9	voiceless sounds
		4	initial position	4	initial position
		2	medial position	4	medial position
		6	final position	4	final position
Most Difficult	12	8	fricatives	8	fricatives
		5	voiceless sounds	3	voiceless sounds
		4	initial position	3	initial position
		1	medial position	3	medial position
		7	final position	6	final position

*Affricate /č/ with fricative /š/ in the initial position. 66%

Voiceless fricatives /š/-/s/ in the final position. 69%

Voiceless stops /p/-/t/ in the final position. 73%

Voiced fricatives /v/-/ð/ in the initial position. 73%

<u>Most Difficult Test Items - L.S.E.S. Students</u>

The 10 per cent of items which students from the L.S.E.S. group found to contribute most difficulty in discrimination were those items in which fewer than 56 per cent of the students answered correctly. These items are presented as follows:

*Voiced fricatives /v/-/ð/ in the final position. 18%

*Voiceless fricatives /θ/-/f/ in the initial position. 42%

*Voiced stops /b/-/g/ in the final position. 42%

*Affricate /ǰ/ with fricative /ž/ in the medial position. 43%

*Voiceless stops /p/-/k/ in the final position. 45%

*Voiced stop /b/ with voiced fricative /v/ in the initial position. 47%

*Voiceless stop with voiceless fricative /p/-/θ/ in the final position. 49%

Nasals /n/-/ŋ/ in the medial position. 51%

*Nasals /n/-/ŋ/ in the final position. 52%

*Affricate /č/ with fricative/š/ in the initial position. 52%

Voiced fricatives /z/-/ʒ/ in the medial position. 54%

Voiced stop /d/ with voiced fricative /ð/ in the final position. 55%

When considering the twelve most difficult items, that is, the poorest 10 per cent of items for each of the two socio-economic groups, it was noted that nine of these items were common to both the L.S.E.S. and the O.S.E.S. groups. These have been marked with an asterisk. However, the O.S.E.S. group percentage of knowing the correct answer was superior to that of the L.S.E.S. group.

In the most difficult 10 per cent of the items for the O.S.E.S. group, there were eight items which included fricatives, five items were voiceless comparisons, four were in the initial position, one in the medial position, and seven in the final position.

The most difficult 10 per cent of the items for the L.S.E.S. group included eight fricatives, three voiceless comparisons, three in the initial position, three in the medial position, and six in the final position.

From this analysis, it appears that the majority of items which the L.S.E.S. group found to be most difficult were also the most difficult for the O.S.E.S. group. There were nine comparisons common to both socio-economic groups in the 10 per cent of most difficult items. Invariably, however, the L.S.E.S. found these items much more difficult than the O.S.E.S. group, since the 10 per cent of items most difficult to discriminate for the O.S.E.S. were those in which 75 per cent or fewer of the students received correct answers, while for the L.S.E.S. were those in which 56 per cent or fewer students obtained correct answers.

III. SUMMARY

The analysis of the Fast-Cosens Auditory Discrimination Test revealed that the type of sounds most difficult for students of both socio-economic groups without considering position were the nasals, while the glides and the lateral /l/ proved to be the least difficult. When voicing was taken into consideration, the voiced fricatives were the most difficult for all students and the voiceless fricatives were the least difficult items. Table XIII summarizes the difficult index level for test items when considering position of sounds. It was established that the most difficult items for both socio-economic groups were the stops in the final position, and the affricates in the initial position. The L.S.E.S. group also found the nasals in the final position difficult, while the O.S.E.S. group found these comparisons relatively easy.

When position and voicing were analysed together, the voiced fricatives in the final position were the most difficult for all students in the test sample. The voiceless fricatives in the medial position were the least difficult for all students from both socio-economic status groups.

There apparently is difficulty when each aspect is considered separately and also difficulty when two or more aspects such as type of sound and position are considered together. Consideration must be given to more than just the type of sound.

The type of sound, position of the sound, the voicing, and the environment of the phoneme all play a part in the discriminability of a particular speech sound. It is not much help to consider only one aspect of a sound in isolation although the information contributes to the knowledge of the total problem.

This chapter consisted of an analysis of the student performance on the Fast-Cosens Auditory Discrimination Test. From this breakdown, the results revealed that the O.S.E.S. group scored much higher on most types of items than the L.S.E.S. group. Those items which tended to be trouble spots for the O.S.E.S. group were also the trouble spots for the L.S.E.S. group.

The implications and conclusions drawn from these findings will be presented in the final chapter.

CHAPTER VI

FINDINGS: THE COMPUTATION OF CORRELATIONS AND THE ANALYSES OF VARIANCE

I. INTRODUCTION

This chapter discusses the correlations of the various predictor variables with the criterion variable, auditory discrimination, to show the interrelationships. The predictor variables are: reading achievement, socio-economic status, intelligence quotients, sex, and chronological age. The intercorrelations among variables other than auditory discrimination will be considered to assess the interplay among these variables, and to show their effect on the variance of scores on the criterion variable. Following a discussion of intercorrelations, the results of the step-wise linear regression will be analysed to determine the significance of each variable as a predictor of auditory discrimination on the total test sample. Next, one-way analysis of variance will be discussed to show the effect of reading achievement, and of socio-economic status on the auditory discrimination scores. Then, two-way analysis of variance by reading achievement and socio-economic status on the total test sample will be considered to determine the relationship between socio-economic status and reading achievement on the criterion variable, auditory discrimination. For the purpose of this study, the five and one per cent levels of significance were accepted.

II. MULTIPLE CORRELATIONS BETWEEN AUDITORY DISCRIMINATION AND THE PREDICTOR VARIABLES

This section presents information on correlations between the criterion variable, auditory discrimination, and each of the predictor variables: sex, intelligence, and chronological age. The correlations are presented by giving an overview of each of the four student groups, as well as the total test sample.

When correlating sex with auditory discrimination, no significant correlation was found except in the O.S.E.S.-Low Reading Group where the correlation approached significance at the .05 level with a correlation of .33 (Table XVII). This indicates that the girls in that student group achieved slightly higher scores in auditory discrimination than the boys. No other correlation of each of sex, intelligence and chronological age was significant with auditory discrimination within each of the four student groups. Therefore, the null hypothesis stating that there will be no significant correlation between auditory discrimination and 2,(a) sex, 2,(b) intelligence, and 2,(c) chronological age, when calculated on the basis of each of the four student achievement groups was accepted.

In considering the total test sample of 120 students, intelligence was found to be significantly correlated with auditory discrimination beyond the .01 level. Thus the null hypothesis 2(b)

TABLE XVII

CORRELATIONS OF VARIABLES

Student Groups	Aud. Disc. with Sex	Aud. Disc. with I.Q.	Aud. Disc. with Chron. Age	Sex with I.Q.	Sex with Chron. Age	Chron. Age with I.Q.
1. L.S.E.S.-L.Rdg. N = 30	.08	.22	.16	-.36*	-.18	.11
2. L.S.E.S.-O.T.L. Rdg. N = 30	-.09	.01	.04	-.45**	-.08	-.07
3. O.S.E.S.-L.Rdg. N = 30	.33	.11	.27	-.08	.03	.05
4. O.S.E.S.-O.T.L. Rdg. N = 30	.08	-.00	.01	-.22	.21	-.17
5. Total Sample N = 120	.09	.28**	.11	-.22**	.00	-.02

*Significant at the .05 level when N = 30, r .349 (Guilford, p. 580).

**Significant at the .01 level when N = 30, r .449 (Guilford, p. 580).

stating that there will be no significant correlation between auditory discrimination and intelligence, when calculated on the total test sample, was rejected.When considering the correlations between auditory discrimination and sex, as well as auditory discrimination and chronological age of the total test sample, no significant correlation was determined. Therefore, the null hypotheses 2(a) and 2(c) when calculated on the total test sample was accepted.

Summary

According to the data analysed, the factors which were not significantly related to auditory discrimination were chronological age and sex. Intelligence was significantly correlated to auditory discrimination when considering the total test sample, but not when taking each of the student groups independently.

III. INTERCORRELATIONS AMONG VARIABLES OTHER THAN THE CRITERION, AUDITORY DISCRIMINATION

Table XVII gives an overview of the intercorrelations among variables and indicates the relationship between these variables. Each of these variables will be discussed in each socio-economic status group and each reading achievement group, as well as in the total test sample.

When considering the L.S.E.S.-Low Reading Achievement group, the only significant intercorrelation as indicated in Table XVII,

was sex with intelligence. The computer program was set up in such a way that when sex was correlated with another predictor variable, a negative correlation would indicate an intercorrelation with boys, while a positive correlation would indicate an intercorrelation with girls. Sex showed a negative correlation, significant at the .05 level with intelligence. This finding indicates that boys in the L.S.E.S.-Low Reading Achievement group had significantly higher intelligence quotients than the girls in this group. The intercorrelations between sex and chronological age, and between intelligence and chronological age were not significantly related in the low socio-economic groups. Table XVII further indicates a significant negative correlation between sex and intelligence in the L.S.E.S.-O.T.L. Reading Achievement group, at the .01 level. This again indicates that the boys from the L.S.E.S. group had higher intelligence quotients than the girls.

Once again, there was no significant correlation among the other predictor variables in the O.S.E.S. student groups.

Conclusions may be drawn, that boys from low socio-economic status areas have higher intelligence quotient scores than girls from low socio-economic status areas as measured by the Lorge-Thorndike Intelligence Test. However, the correlation of auditory discrimination with sex in the L.S.E.S. groups failed to reach the accepted level of significance. One can, therefore, conclude that although boys from the low socio-economic groups have higher

intelligence quotients than girls from the low socio-economic groups, the auditory discrimination of boys is not superior to girls.

Table XVII indicates that there is no significant relationship between sex and intelligence, sex and auditory discrimination, and sex and chronological age in the O.S.E.S.-Low Reading Achievement group, as well as in the O.S.E.S.-O.T.L. Reading Achievement group. Thus, it appears from the sample of sixty other than low socio-economic students, that there is no significant difference between the intelligence quotients of boys and girls as measured by the Lorge-Thorndike Intelligence Test. The intercorrelations between sex and chronological age, as well as intelligence and chronological age, failed to reach the accepted levels of significance in both of the O.S.E.S. groups.

When intercorrelations on the total test sample were considered, there was a high negative correlation between sex and intelligence, indicating that boys on the whole had higher intelligence quotients than the girls. The correlation was -.22 which proves to be significant at the .01 level of confidence. Considering further the total test sample, intelligence and auditory discrimination correlated significantly at the .01 level of significance. This would indicate that students with higher intelligence quotients performed significantly better on the Fast-Cosens Auditory Discrimination Test than did children with lower intelligence. When considering the mean intelligence scores on each of the four

student groups, as illustrated on Table VI), it is apparent that the L.S.E.S.-Low Reading group has the lowest intelligence quotients with a mean score of 101, and also the lowest auditory discrimination scores with a mean auditory score on the Fast-Cosens Auditory Discrimination Test of 199.50 while the O.S.E.S.-O.T.L. Reading group has the highest intelligence quotient with a mean score of 114 and also the highest auditory discrimination score, with a mean auditory discrimination score of 237.23 on the same test.

Summary

From scanning the individual student scores and noting the positive correlation between auditory discrimination and sex, it appears that girls tend to have higher auditory discrimination scores than boys, despite the fact that the boys in this test sample have slightly higher intelligence quotients than the girls. However, since intelligence plays an important part in auditory discrimination, and since boys in this test sample have higher intelligence quotients than the girls, the differences in auditory discrimination when considering sex are below statistical significance. No other intercorrelations were found to be significantly correlated. Chronological age was not significantly related to any of the predictor variables.

IV. STEPWISE LINEAR REGRESSION ANALYSIS

In order to ascertain the contribution of each variable as a predictor of auditory discrimination, and to determine the best set of variables with the greatest variance on the Fast-Cosens Auditory Discrimination Test, stepwise linear regression analysis was utilized. Correlations between certain variables and the auditory discrimination test are illustrated in Table XVII, in a simple correlation matrix. These serve as a guide to note the order of the variables from the one denoting the most test variance to the one contributing the least variability in auditory discrimination. The predictor variable most highly correlated with the criterion variable was first entered into the regression equation. Additional variables were added to the regression at each step. With the addition of each predictor variable the test variance attributed to the variable was added to the initial test variance.

Table XVIII illustrates the regression upon each of the variables as they are added step by step. The total sum of squares remains constant, but at each step of the regression the variables added reduce the error or residual sum of squares. Since the variables are additive and the best single predictor is placed as the first predictor variable, the F ratios are all significant at the .01 level as was anticipated. The Lorge-Thorndike Intelligence Test predicted a significant amount of the total variance on

TABLE XVIII

STEPWISE LINEAR REGRESSION OF INTELLIGENCE, SEX, AND CHRONOLOGICAL AGE

Step No.	Sources of Variance (sums of squares)								
	Regression on Variables no:	Regression Sum of Sq.	Residual (error) S.Sq.	Total S.Sq.	Mean Sq.	D.F.	F.	p.	% of variance accounted for
Step #1	1(I.Q.)	5249.97	57408.06	62658.00	5249.94 486.51	1 118 119	10.79	.001**	8.4
Step #2	1,2 (I.Q.,Sex)	7009.09	55648.91	62658.00	3504.54 475.63	2 117 119	7.36	.0009**	2.8
Step # 3	1,2,3 (I.Q.,Sex,Age)	7870.69	54787.30	62658.00	2623.56 472.30	3 116 119	5.55	.001**	1.4

**Significant at .01 level.

the auditory discrimination scores. The percentage of variance accounted for was 8.4 per cent and was significant at the .01 level of confidence. Another 2.8 per cent of variance was accounted for when the sex variable was added. Although chronological age as a variable in itself was not statistically significant, it did yield 1.4 per cent of the variance on the regression analysis. The three variables together contributed a total of 12.56 per cent of the total variance of the test scores.

The total variance unaccounted for was 87.44 per cent. It could be anticipated that reading achievement and socio-economic status would have contributed much to the variance of auditory discrimination scores had they been entered into the correlation matrix, since they were found on Table XIX. However, since the total test sample was divided into four equal groups on two criteria; namely, socio-economic status and reading achievement, and since both were significantly related to auditory discrimination, it was decided to omit these two variables from the regression analysis in order to determine which of the other variables would contribute most to the variance, and how much these variables would contribute to the total variance on the auditory discrimination scores.

Summary

Table XIX indicates the significance of each of the four groups in the test sample to be highly significant with auditory discrimination at the .01 level of confidence. Through the com-

TABLE XIX

MEANS, STANDARD DEVIATIONS, F-RATIOS, AND LEVEL OF SIGNIFICANCE OF: EACH OF THE FOUR STUDENT GROUPS, AND OF THE TOTAL TEST SAMPLE

Student Group	Mean Aud. Dis. Score	Standard Deviation	F-Ratio	Level of Significance*
L.S.E.S.-Rdg. Ach.	207.50	24.52	6.84	.01**
O.S.E.S.-Rdg. Ach.	228.80	14.70	28.43	.000002**
Low Rdg.	209.95	23.62	13.71	.0004**
O.T.L. Rdg.	226.35	18.50	30.68	.000001**

*Level of significance is rounded off to the first number.
**Significance beyond the .01 level.

putation of a correlation matrix, with each of the four student groups, as well as the total test sample, an attempt was made to determine the significance of the remaining predictor variables: intelligence, sex, and chronological age. It was found that intelligence was significantly correlated with auditory discrimination for the total test sample. However, no significant correlation was found between auditory discrimination and intelligence when each of the four student groups were considered independently. Thus, the null hypothesis stating that there will be no significant correlation between auditory discrimination and intelligence was rejected when considering the total test sample, but was accepted when considering each of the student groups independently.

Further correlations between auditory discrimination and each of the following: sex, and chronological age failed to reach the designated levels of significance with any of the student groups and with the total test sample. Thus, the null hypothesis 2(a) and 2(c) when calculated on the basis of each of the four student groups and of the entire test sample was accepted.

The intercorrelations of the four variables revealed a significant correlation between sex and intelligence for the total sample. Boys were found to have higher intelligence quotients than the girls. In both of the low socio-economic groups the boys' intelligence quotients were significantly higher than the girls'. The girls in the O.S.E.S.-Low Reading Achievement group tended to get

slightly higher auditory discrimination scores than the boys, but this failed to reach the accepted significance level.

In the stepwise linear regression analysis, intelligence was the best predictor of auditory discrimination. The total variance accounted for by intelligence, sex and chronological age was 12.56 per cent.

V. ONE-WAY ANALYSIS OF VARIANCE

Auditory Discrimination and Reading Achievement

To determine whether auditory discrimination had any effect on reading achievement scores, one-way analysis of variance was used. The reading achievement scores were divided into two groups: low reading achievement; and O.T.L. reading achievement. Those who received grade level scores of greater than 2.00 on the *Metropolitan Reading Achievement - Primary I, Form B, Test*, were designated as O.T.L. reading achievers. Those students who received grade level scores of less than 2.00 were designated to the low reading achievement group. For each of the two reading achievement groups, that is the low and the other than low, one-way analysis of variance was completed to find out if the variance among the test means varied significantly from the grand mean. Table XX summarizes the results and presents the means, standard deviations and level of significance of the auditory discrimination scores obtained by each of the two reading achievement groups.

TABLE XX

ONE-WAY ANALYSIS OF VARIANCE ON AUDITORY DISCRIMINATION SCORES FROM

THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Student Groups (N = 60)	Source	Sums of Sq.	Mean Sq.	Degrees of Freedom	F.	p.
1. L.Rdg.Ach.	L.Rdg.Ach.	6509.00	6509.00	1	13.71	.0004**
	Error (within)	27540.00	474.83	58		
2. O.T.L. Rdg. Ach.	O.T.L. Rdg. Ach.	7106.00	7106.00	1	30.68	.000001**
	Error (within)	13434.00	231.67	58		
3. L.S.E.S.-Rdg.Ach.	L.S.E.S. Rdg.	3808.00	3808.00	1	6.84	.01**
	Error (within)	32270.00	556.38	58		
4. O.S.E.S.-Rdg.Ach.	O.S.E.S.-Rdg.	4266.00	4266.00	1	28.43	.000002**
	Error (within)	8704.00	150.07	58		

**Significant at the .01 level.

The results indicated that there was a significant positive relationship between reading achievement and auditory discrimination scores in both the low reading achievement group and in the O.T.L. reading achievement group, significant at the .01 level of significance. This analysis, therefore, ascertained that reading achievement is highly related to success in auditory discrimination as measured by the Fast-Cosens Auditory Discrimination Test.

Hypothesis I,(d) states that in analysing auditory discrimination scores there will be no significant simple main effects for reading achievement. That is to say, there will be no significant relationship between the mean auditory discrimination scores and low reading achievement of students in the test sample; and that there will be no significant relationship between the mean auditory discrimination scores and O.T.L. reading achievement of students in the test sample. When considering auditory discrimination scores and low reading achievement, the null hypothesis was rejected since the relationship was significant at the .0004 level of significance. This hypothesis was also rejected for the O.T.L. reading achievement group, since auditory discrimination and reading were found to be significant beyond the .01 level.

Auditory Discrimination and Socio-economic Status

When one-way analysis of variance was utilized on the reading achievement of the L.S.E.S. group, as indicated on Table XX,

socio-economic status was significantly related to auditory discrimination at the .01 level of confidence. Students in the L.S.E.S. group had a mean score of 207.50 on auditory discrimination, while students from the O.S.E.S. group had a mean score of 228.80. One-way analysis was again utilized on the O.S.E.S. group to determine the relationship between reading achievement of the O.S.E.S. group and auditory discrimination. A significant relationship was ascertained beyond the .01 level of significance. Thus, the null hypothesis stating that there would be no significant relationship between auditory discrimination and socio-economic status was rejected. The findings indicated that socio-economic status plays a significant role in the way first grade students discriminate auditorially.

Summary

Both low and O.T.L. reading achievement were found to be significantly related to auditory discrimination. When consideration was given to the total test sample of O.S.E.S. students, O.S.E.S. was highly indicative of success on auditory discrimination scores. The L.S.E.S. group was also indicative of success on auditory discrimination at the .01 level of significance.

VI. TWO-WAY ANALYSIS OF VARIANCE ON AUDITORY DISCRIMINATION SCORES BY SOCIO-ECONOMIC STATUS AND READING

Two-way analysis of variance was computed in order to determine the degree of variance on the Fast-Cosens Auditory Discrimination Test scores by socio-economic status and reading achievement. The two-way analysis program calculated the statistical F test based upon the reduction in error sums of squares from a restricted to an unrestricted model. The factors of S.E.S. and reading achievement, plus their interactions were weighted to minimize the error sums of squares.

Table XXI summarizes the results of the two-way analysis program. Interaction between reading and socio-economic status were not significant, but the main effects of reading as well as those of socio-economic status were significantly related to auditory discrimination beyond the .01 level. The result of the one-way analysis as well as the two-way analysis seem to indicate that success in auditory discrimination is an important contribution to success in reading achievement. When socio-economic status in itself was considered, it was found to be an important and powerful factor in determining success in auditory discrimination of first grade students.

Summary

It appears from the analysis that socio-economic status and

TABLE XXI

TWO-WAY ANALYSIS OF VARIANCE ON AUDITORY DISCRIMINATION SCORES OF STUDENTS BY SOCIO-ECONOMIC STATUS AND READING ACHIEVEMENT

Source	Sum of Sq.	Mean Sq.	D.F.	F.	p.
S.E.S.	13608.46	13608.46	1	38.53	.000**
Rdg.	8067.46	8067.46	1	22.84	.000**
S.E.S.-Rdg. Interaction	6.54	6.54	1	.019	.89
Error (within)	40974.00	353.22	116		

**Significant at the .01 level.

reading achievement are both predictive of success in auditory discrimination. The null hypothesis I (a) and (b), stated that in analysing auditory discrimination scores, there will be: no significant main effect due to reading achievement; and no significant main effect due to socio-economic status. These null hypotheses were rejected since the effect of both reading achievement and socio-economic status on auditory discrimination scores were found to be significant at the .01 level of confidence. The null hypothesis, I,(c), stating that there would be no significant interaction between reading achievement and socio-economic status was accepted since the interaction failed to reach the designated .05 level of significance.

VII. SUMMARY

A comparison of the mean scores on the Fast-Cosens Auditory Discrimination Test indicated that the L.S.E.S. groups performed more poorly than the O.S.E.S. groups. It appears that socio-economic status is an important aspect in the development of auditory discrimination of students. Correlations of the predictor variables with the criterion were discussed. The variable most highly correlated to the criterion, auditory discrimination, was intelligence as measured by the Lorge-Thorndike Intelligence Test. Intercorrelations were then presented, and the findings revealed that sex and intelligence were negatively correlated, indicating that

the boys in the test sample had higher intelligence quotients than the girls. Stepwise linear regression was computed using the variables, sex, chronological age and intelligence. The total contribution of the three variables was 12.56 per cent. Both one and two-way analysis were considered in order to determine the significance of socio-economic status and reading achievement on auditory discrimination ability. Results ascertained a highly significant relationship between socio-economic status and auditory discrimination ability, as well as a significant relationship between auditory discrimination and reading achievement. The interaction effect between socio-economic status and reading achievement in the two-way analysis of variance failed to be significant at the .05 level.

CHAPTER VII

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

This chapter presents a summary of the study. In addition it contains the findings, conclusions, and implications for the teaching of reading, as well as recommendations for further research.

I. SUMMARY

The reading process includes the translating of written symbols into sound symbols and then into meaningful units. This infers that the sounds must be heard as separate entities in the words before students can be expected to associate the phonemes with their grapheme counterparts. Research (22) (63) (75) has indicated that adequate auditory discrimination may be an influential cause of success in reading achievement. Further research (16) (67) has also ascertained that experience and practice in oral language which expose the subject to auditory stimuli are important elements in improving sound discrimination of students. Different socio-economic strata may provide such varied experiences and practice in oral language that the auditory discrimination of students is affected and subsequently their reading achievement is affected.

The purpose of this study was to compare the auditory

discrimination of selected speech sounds of first grade students in low socio-economic areas with that of first grade students in other socio-economic areas, and to relate these findings to their reading achievement.

For this investigation, two groups of sixty students each were chosen randomly from a total population sample of 612 students enrolled in eight elementary schools in the city of Saskatoon. Four of these schools were designated by school officials as being in a low socio-economic area, and four schools were in an area other than low. Sixty students from each of the two socio-economic areas were selected as the test sample. The Blishen Occupational Class Scale was then utilized to verify the socio-economic status of each student by averaging the occupational class score of each student's parents. The reading achievement level for each subject was determined by using the results of the Metropolitan Reading Achievement Test, Primary 1, Form B. Subjects with a grade score of greater than 2.00 were designated as the O.T.L. reading achievement group, while those with grade scores of 2.00 or less were considered as low reading achievers. Each socio-economic group of sixty students was then divided into low and other than low reading achievement groups. Thus, the final breakdown consisted of four separate groups of thirty students in each group as follows: L.S.E.S.-Low Reading; L.S.E.S.-O.T.L. Reading; O.S.E.S.-Low Reading; and O.S.E.S.-O.T.L. Reading.

A screening test for hearing acuity was administered to all students using Maico audiometers. Students with a fifteen decibel hearing loss as measured by the American Standards Association norms, or a twenty-five decibel hearing loss as measured by the 1964 International Standards Organization norms, were considered deficient in hearing and therefore excluded from the study; two students were excluded. The intelligence test scores as determined by the Lorge-Thorndike Intelligence Test, Level 1, sex and chronological age of each student were obtained from the school cumulative record folder.

The Fast-Cosens Auditory Discrimination Test was then administered to each student individually to determine his ability to discriminate between minimal word pairs. Two words were presented consecutively in which the child was asked to indicate whether or not the word pairs were the same or different. He would raise his hand if the words were different.

The results of the data obtained from the testing program were processed at the University of Alberta's Computing Centre. The means and standard deviations of scores on each variable for the total test sample of 120 students were obtained in order to describe the test sample. Correlations and intercorrelations among variables procured, gave an indication of the relationships among

auditory discrimination, sex, intelligence, and chronological age. The stepwise linear regression was utilized to determine which set of variables accounted for the most variance and for the total variance on the criterion variable. One-way analysis of variance was employed in order to ascertain what effects reading and socio-economic status had on auditory discrimination ability of first grade students. Then two-way analysis of variance was utilized to determine the interaction between socio-economic status and reading on student auditory discrimination. Finally, an analysis of the Fast-Cosens Auditory Discrimination Test was undertaken to determine which types of sounds were trouble-spots for first grade students. The main findings from the data analyses and the subsequent conclusions reached will be discussed in the following section.

II. MAIN FINDINGS AND CONCLUSIONS

For the sake of continuity, this section is arranged according to the hypotheses stated in Chapter I.

Null Hypothesis I

In analysing auditory discrimination scores, there will be:

a) no significant main effect due to reading achievement;

b) no significant main effect due to socio-economic status;

c) no significant interactions between reading and socio-economic status;

d) no significant <u>simple</u> main effects for reading achievement; and

e) no significant <u>simple</u> main effects for socio-economic status.

Parts a, b, and c of this hypothesis were analysed using two-way analysis of variance. The findings revealed that reading achievement as measured by the <u>Metropolitan Reading Achievement Test, Primary I, Form B</u> was related beyond the .01 level of significance to performance on the <u>Fast-Cosens Auditory Discrimination Test</u>. The findings also showed that socio-economic status was related beyond the .01 level of significance to performance on the auditory discrimination test as illustrated in Table XIX, Chapter VI. However, there was no significant interaction effect on reading and socio-economic status in relation to auditory discrimination scores.

When considering the entire test sample it appears that in analysing auditory discrimination scores, both reading and socio-economic status of the student have a significant effect on predicting success on the criterion variable. The null hypothesis is therefore rejected. The socio-economic status of the student and his reading achievement are significantly related to auditory discrimination as measured by the <u>Fast-Cosens Auditory Discrimination Test</u>.

<u>Null Hypothesis I, Parts d, and e</u>

In order to determine the <u>simple</u> main effects due to read-

ing achievement as well as the _simple_ main effects due to socio-economic status in analysing auditory discrimination scores, one-way analysis of variance was utilized.

When the students were divided into two groups, namely low reading and O.T.L. reading groups according to their test scores on the _Metropolitan Reading Achievement Test, Primary I, Form B_, the analysis indicated that the two means within each reading achievement group varied significantly one from the other. The results indicated that there was a significant relationship beyond the .01 level between low reading and auditory discrimination, as well as a highly significant relationship beyond the .01 level between O.T.L. reading and auditory discrimination ability. In both instances, the O.S.E.S. group performance on auditory discrimination was better than that of the L.S.E.S. group.

When the L.S.E.S. group and the O.S.E.S. group were considered, to determine the effect of auditory discrimination, the results indicated that the means within each socio-economic status group differed significantly one from the other. There was a significant relationship between auditory discrimination and reading achievement in the L.S.E.S. group as well as in the O.S.E.S group. It was further indicated that socio-economic status was related to success in auditory discrimination, since the O.S.E.S. groups performed significantly higher than the L.S.E.S. groups on the _Fast-_

Cosens Auditory Discrimination Test. Parts (d) and (e) of the null hypothesis are therefore rejected.

Null Hypothesis II, (a)

There will be no significant correlation between auditory discrimination and sex on: the total test sample; L.S.E.S.-Low Reading Achievement; L.S.E.S.-O.T.L. Reading Achievement; O.S.E.S.-Low Reading Achievement; and O.S.E.S.-O.T.L. Reading Achievement.

An examination of the correlations between sex and auditory discrimination on each of the five groups stated above, denoted that sex was not significantly related to auditory discrimination with any of the five groups. However, the correlation of sex and auditory discrimination was approaching significance at the .05 level of the O.S.E.S.-Low Reading group. This correlation of .33 would indicate that girls in the O.S.E.S.-Low Reading group were somewhat better discriminators than the boys. The conclusions drawn from this analysis seem to indicate that in this test sample, sex does not influence the discrimination ability of fine nuances in word-pairs. The null hypothesis stated above, has therefore been accepted.

Null Hypothesis II, (b)

There will be no significant correlation between auditory

discrimination and intelligence on: the total test sample; L.S.E.S.-Low Reading Achievement; L.S.E.S.-O.T.L. Reading Achievement; O.S.E.S.-Low Reading Achievement; and O.S.E.S.-O.T.L. Reading Achievement.

Results from this analysis indicated that there was no significant relationship between intelligence and auditory discrimination scores when considering each of the two socio-economic groups and the reading achievement groups. However, when examining the correlation on the total test sample between intelligence and auditory discrimination, intelligence was significantly related to auditory discrimination at the .01 level. Students with higher intelligence quotients regardless of socio-economic status tend to perform better on the auditory discrimination test. Therefore, the null hypothesis was not accepted when consideration was given to the total test sample, but was accepted when considering each student group individually.

Null Hypothesis II, (c)

There will be no significant correlation between auditory discrimination and chronological age on: the total test sample; L.S.E.S.-Low Reading Achievement; L.S.E.S.-O.T.L. Reading Achievement; O.S.E.S.-Low Reading Achievement; and O.S.E.S.-O.T.L. Reading

Achievement.

Correlations between chronological age and auditory discrimination were calculated on each of the groups indicated above. It was found that age was not significantly correlated with any of the four groups or with the total test sample. In the O.S.E.S.-Low Reading Achievement group the tendency indicates that girls are slightly older than the boys. In this group, the girls also performed slightly higher on auditory discrimination scores. However, this failed to reach the accepted level of significance. The mean chronological age for the test sample was 82.1 months, with a standard deviation of 3.9 months. It is quite possible that if the variance in age had been greater, the chronological age would have been of significance. However, results do not indicate a significant difference in this experiment, and the null hypothesis has been accepted. Chronological age was not significantly related to auditory discrimination.

Intercorrelations

A further analysis which included intercorrelations among variables was utilized. The conclusions derived from the intercorrelations between sex, intelligence, and chronological age indicated that the boys in the L.S.E.S.-Low Reading Achievement

group had significantly higher scores than the girls. This relationship was significant beyond the .05 level. Similarly, in the L.S.E.S.-O.T.L. Reading Achievement group, the boys' intelligence quotients were significantly higher than the girls'. This correlation between sex and intelligence was significant at the .01 level. In the total test sample, the only intercorrelation other than the criterion variable was sex with intelligence. Again, the boys had significantly higher intelligence quotients than the girls. Boys from lower socio-economic areas in this test sample have higher intelligence quotients than the girls, but there is no apparent difference in the intelligence quotient scores of children from other socio-economic areas.

Since intelligence was significantly related to auditory discrimination in the total test sample, and since the boys' intelligence quotients were higher than the girls', it follows that these boys should have obtained higher scores on the auditory discrimination test. However, this difference failed to be significant because girls generally mature earlier than boys. It appears that auditory discrimination is developmental and that maturation may be a factor in auditory discrimination.

Special Question

In determining which set of variables was significantly related to auditory discrimination and to determine the rank order of these variables, stepwise linear regression analysis was utilized.

Since intelligence was the best single predictor of auditory discrimination, it follows that intelligence accounted for the most variance in the stepwise linear regression model as indicated on Table XVIII. The results indicated that intelligence accounted for 8.4 per cent of the variance on auditory discrimination. With the sex variance of 2.8 and chronological age of 1.4 added, the total variance accounted for was 12.56 per cent. By deduction, it would appear that socio-economic status and reading achievement could account for most of the remaining variance since both were significantly related to auditory discrimination as measured by the Fast-Cosens Auditory Discrimination Test. The results, therefore, of the stepwise linear regression analysis indicated that intelligence, sex, and chronological age in that order were the three variables which made up the set of predictor variables.

III. FURTHER FINDINGS AND CONCLUSIONS FROM THE FAST-COSENS AUDITORY DISCRIMINATION TEST ITEM ANALYSIS

For the purpose of presenting additional conclusions drawn from the analysis of the Fast-Cosens Auditory Discrimination Test, it was found desirable to include only some of the pertinent findings since the analysis involved numerous minute details.

An investigation of the Fast-Cosens Auditory Discrimination Test indicated that the glides were the easiest type of sound for first grade students to discriminate. Eleven glide comparisons were made and only in one case, that is, with the word pair 'waft--raft' did the O.S.E.S. group encounter some difficulty. In this instance, 71 per cent of all students received the correct answer. Since students generally found the medial and final positions of sounds more difficult than the initial sounds, it is possible that the glides are the easiest to distinguish since it is not possible to make any minimal word pairs in the final position with glides.

The most difficult type of item as measured by the Fast-Cosens Auditory Discrimination Test was the nasals. In the nasal comparisons, 75 per cent of the O.S.E.S. group and 58 per cent of the L.S.E.S. group answered correctly. The /n/-/ŋ/ comparisons were much more difficult for all students than the /m/-/ŋ/. The /n/-/ŋ/ in the medial and final positions caused most difficulty, especially for the L.S.E.S. group. The percentage of difficulty between the

L.S.E.S. group and the O.S.E.S. group was 20 per cent in the medial position, and 29 per cent in the final position in favor of the O.S.E.S. group. This indicates that the L.S.E.S. group had much more difficulty with these sounds than the O.S.E.S. group. It would appear that since nasals are often poorly pronounced, especially where speech is carelessly enunciated, and children who have poor speech models as is often the case in L.S.E.S. areas, that these sounds are not discriminable by students who lack accurate articulation and who have poor speech models.

In analysing word-pairs with regard to voicing, it was established that the voiced fricatives were the most difficult items for both socio-economic groups of students. The O.S.E.S. scores were 17.5 per cent better than the L.S.E.S. The most difficult items were the voiced fricatives in the final position. Here only 64 per cent of the O.S.E.S. group and 49 per cent of the L.S.E.S. group obtained correct answers. The item that caused the most difficulty was the /v/-/ð/ comparison. In the O.S.E.S. group only 24 per cent received the correct answer, while 18 per cent of the L.S.E.S. group could distinguish between these sounds. This conclusion is substantiated by Miller and Nicely's (56) findings in which they indicated that the distinctions between /v/ and /ð/ and between /f/ and /θ/ were among the most difficult to hear.

Although the voiceless fricatives of the test items secured higher scores than the voiced fricatives, the distinction between

/f/-/θ/ attained the second lowest scores on the entire test. In the O.S.E.S. group 45.5 per cent of the students distinguished correctly between these sounds, while in the L.S.E.S. group 41.6 per cent distinguished the difference between /f/-/θ/. These findings tend to confirm the results recorded by Poole (70) who indicated that /v/ and /ð/ are among the last sounds to be mastered by children, and are mastered at age six and one-half years; and that /f/ is mastered at five and one-half years, while /θ/ is mastered at seven and one-half years.

Conclusions can then be drawn that: first, since the discrimination of sounds appears to be developmental, those sounds mastered at a later age cause most difficulty to students; and second, since perceptual development takes place through a child's sense modalities and is stimulated by his environment, that students could have difficulty with these sounds, and that children from low socio-economic areas often perform less well than children from other socio-economic areas, however, the same patterns of difficulty were common to students of both socio-economic groups.

When considering minimal word pairs on position of sound, the final stops and the initial affricates were the most difficult items for all students. Once again, the O.S.E.S. group performed higher than the L.S.E.S. group with the difference being 15 per cent in favor of the O.S.E.S. The stops which created the most difficulty were the voiceless stops /p/-/k/ in the final position, with 56.7 per cent of the O.S.E.S. and 45.0 per cent of the L.S.E.S.

obtaining correct answers. These results substantiate the research of Miller and Nicely (56) who found that it was most difficult to discriminate between places of articulation. The voiced stops /b/-/g/ in the final position was also a difficult set of items for students. These comparisons were correctly answered by 63.9 per cent of the O.S.E.S. group and 42.2 per cent of the L.S.E.S. group. It appears that when sound comparisons are made between front and back sounds as /p/ with /k/, students experience undue difficulty, despite the fact that these sounds are mastered by age three and one-half and four and one-half years (Poole, 70). From these findings it appears that place of articulation and position of sounds in words are of significance in determining the auditory discrimination ability of students. These findings should also be considered in diagnosing reading difficulties of children.

Although only three comparisons between the alveopalatal voiceless fricative /š/ and the alveopalatal voiceless affricate /č/ were made, these comparisons were found to be difficult items for both socio-economic groups. They were correctly answered by 66 per cent of the O.S.E.S. group and 51.7 per cent of the L.S.E.S. group. Similarly, the alveopalatal voiced fricative /ž/ and the alveopalatal voiced affricate /ǰ/ comparisons were difficult items for all students, with 46.7 per cent of the O.S.E.S. group and 43.4 per cent of the L.S.E.S. group receiving correct answers. It has

been reported by Templin, Wellman and Poole (70) that these sounds are among the last to be mastered by children. Many students have not matured to the point of mastering these sounds and hence have trouble discriminating them. Students from the low socio-economic areas develop their auditory discrimination abilities more slowly than the students from other socio-economic areas and therefore will require additional help with these sounds.

The comparisons made between voiceless stops and voiceless fricatives were not found to cause difficulty in the initial position. However, the final position of /p/-/ɵ/ was a difficult comparison for all students. Although, according to Poole as reported by Templin (70), /p/ is mastered by age three and one-half, /ɵ/ is not mastered until age seven and one-half years. Since many students cannot hear the /ɵ/ sound they cannot discriminate /p/ from /ɵ/ particularly when environment of the word is taken into consideration. That is to say, the position of the sound within the word and the vowel sound that precedes or follows the phonemic comparison may be an influential factor in discrimination ability.

The voiced stop /b/ with the voiced fricative /v/ in the initial position was another difficult set of items for all students. These comparisons were correctly answered by 56.6 per cent of the O.S.E.S. group and 47.2 per cent of the L.S.E.S. group. When the consonants /v/ and /b/ were followed by the short /o/

vowel sound, students had more difficulty than when the initial consonants were followed by other vowel sounds. The conclusions seem to indicate that the vowel following the consonant or preceding it, plays an important part in determining whether or not the distinction between minimal word pairs can be determined by first grade students.

Another indication of the importance of the environment of the consonant sounds compared is in the differentiation of /t/-/k/ in the medial position. It appears that when /t/ and /k/ are preceded by the long /a/ vowel sound, that students tend to have more difficulty discriminating between minimal word pairs. The poorest performance on the final nasal sounds was in cases where the nasal endings were preceded with the short /u/ vowel sound. It can therefore be concluded that the environment of the phonemes which either precedes or follows the sound being compared may affect the degree to which the word pairs are distinguishable by students.

The total percentage of differences between O.S.E.S. and L.S.E.S. student groups on types of sounds were as follows:

Stops -- 16

Nasals -- 17

Glides and Lateral -- 13

Fricatives -- 11

Affricates -- 12

Stops with Fricatives -- 10

Apart from the glides and the lateral /l/, it appears that the voiced fricatives /v/-/z/ in the medial and final positions are among the easiest for students to distinguish. The voiceless fricatives /š/-/s/ in the initial and medial positions and the /š/-/θ/ in the final position were also relatively easy discriminable items for all students. Although the glides and lateral /l/ were the easiest group of items, many more comparisons in the fricatives were made and these tended to be the next easiest type of items with the voiceless being easier than the voiced fricatives. There are then a number of specific problems in auditory discrimination which children in different socio-economic areas face, collectively as groups and individually as one group from another.

On the entire Fast-Cosens Auditory Discrimination Test the O.S.E.S. group performed 12.5 per cent better than the L.S.E.S. group. Since auditory discrimination is significantly related to reading achievement and since a number of specific sound discriminations are more difficult for the L.S.E.S. students than for the O.S.E.S. students, it follows that a difference of 12.5 per cent in auditory discrimination scores in favor of the O.S.E.S. group indicates a positive advantage for O.S.E.S. students in learning to read.

IV. SUMMARY OF CONCLUSIONS

From the results of the investigation the following conclusions are offered:

1. Students from O.S.E.S. groups perform significantly higher on the auditory discrimination test than L.S.E.S. students when types, position and voicing are considered. Socio-economic status appears to be a predictor of auditory discrimination.

2. The same pattern of difficulty was common to the students of both socio-economic groups, but the degree of difficulty experienced by the L.S.E.S. group was greater than that of the O.S.E.S. group.

3. Boys and girls achieve equally well on auditory discrimination scores as measured by the Fast-Cosens Auditory Discrimination Test.

4. Reading Achievement as measured by the Metropolitan Reading Achievement Test, Primary I, Form B, was significantly related to auditory discrimination. This finding supports Wepman's theory that "there is a positive relation between poor discrimination and poor reading" (75:326).

5. Auditory discrimination appears to be a developmental process, as those sounds which are mastered latest according to Templin, Wellman, and Poole (70) are also those sounds which cause the most difficulty in discrimination for first grade students.

This conclusion supports Wepman's hypothesis (75:326) in which he states that, "the ability to discriminate frequently matures as late as the end of the child's eighth year."

6. The types of sounds which are easiest to distinguish for students are the glides with the lateral /l/. In this experiment, comparisons of glides and lateral /l/ were made primarily in the initial positions.

7. The sound comparisons made in the initial position generally cause less difficulty than those made in the medial and final positions.

8. The type of sound which appears most difficult for students is the nasal. In this experiment, nasals were compared in the medial and final positions only, since it was not possible to make any comparisons of /ŋ/ in the initial position.

9. Voiceless sound comparisons are less difficult on the whole than voiced sounds, and the fricative comparisons are easier to distinguish for all students than the stops.

10. When consideration is given to the interaction of type, position and voicing of sounds, the complexity of these sound comparisons play a definite part in the discriminability of the word pairs.

11. On the basis of these conclusions, it would appear that the nature and extent of a child's oral language experiences as acquired through his association with his home environment does

affect the rate of his auditory perceptual development and that this does influence his ability to successfully accomplish the process of reading.

V. IMPLICATIONS

From the results of this investigation, it seems apparent that many students from different socio-economic areas and particularly from L.S.E.S. areas could benefit from a more extensive period of preparation in auditory discrimination to better facilitate the reading process.

1. Auditory discrimination as measured in this investigation is significantly related to reading achievement. Therefore, a well developed auditory training program in the first grade for those who need it regardless of socio-economic status is time well spent in the teaching of reading.

2. The fact that students from low socio-economic areas score significantly lower on auditory discrimination tests than other students and that auditory discrimination and reading achievement are significantly related especially warrants a well structured auditory training program for low socio-economic students.

    (a) Such a training program should include more opportunity for the student to be exposed to good oral speech models as well as increased opportunity to express themselves orally.

(b) In addition, an auditory discrimination training program should be undertaken in order to help students hear the separate sounds in spoken words. If students are able to hear the phonemes within words, they are more likely to associate the grapheme with the appropriate phoneme, thus accelerating the auditory perceptual aspect of reading and facilitating the reading process.

(c) Such a program should give special attention to the total sound environment of the word and should not present sounds in isolation.

3. Since auditory discrimination appears to be a developmental process, those sounds which are not yet mastered by the time students enter first grade need careful attention. Because the developmental pattern appears to have some differences in time schedule in L.S.E.S. groups, special programs should be implemented as needed.

4. Since L.S.E.S. students begin school with an auditory handicap, a kindergarten or Head Start program should be undertaken with emphasis on auditory perceptual training designed in conjunction with an assessment program which will recognize those students with auditory discrimination problems. This would facilitate a preventive approach to reading problems.

5. Although this study did not include students who spoke a second language at home, the fact that distinctiveness in speech sounds is important for learning to read would indicate that these students may need an extended auditory program with good speech models before formal reading instruction is given.

6. Chronological age is not a significant factor in predicting success in beginning reading. Simply waiting for a child to mature chronologically will not insure success in learning to read.

VI. RECOMMENDATIONS FOR FURTHER RESEARCH

1. Since relatively few experimental studies have been conducted in auditory discrimination upon children entering first grade, it is suggested that further investigations be undertaken to determine the child's auditory abilities upon first entering school and hence accelerate the auditory discrimination of students in a readiness program.

2. It would be interesting to examine the speech and articulation of children, especially those of lower socio-economic classes to determine if sounds which are poorly articulated are also the sounds poorly discriminated, and to determine in which position these phonemes are inaccurately articulated.

3. A thorough study of the development of auditory discrimination of students at different grade levels in the primary

school of different socio-economic areas should be attempted to determine the pattern of development in discrimination.

4. A longitudinal study to determine whether training can reduce the effect of delayed auditory discrimination of lower socio-economic students on reading achievement is needed.

5. Studies of other aspects of auditory discrimination such as auditory memory, and auditory blending should be undertaken to determine the effect of these on reading. Careful attention should be given to the environment in which sounds occur.

6. Studies to determine the effect of a training program in listening at the first grade level should be considered, and tests developed to determine the effect listening has on auditory discrimination in reading.

7. The relationship between auditory discrimination and intelligence needs further investigation at the grade one level.

8. A study to examine the environment of the phoneme used in word comparisons needs investigation, to determine whether certain vowel sounds and/or blends which precede or follow the phonemes compared, affect the student's ability to discriminate particular word pairs.

9. A language maturation test measurement should be constructed to provide a more effective assessment of oral language development in relation to environmental background.

VII. CONCLUDING STATEMENT

This investigation has shown that the socio-economic status of the student is significantly related to auditory discrimination of first grade students. In addition, success in auditory discrimination is one of several factors that have received too little consideration by educational researchers, and too little programatic consideration from teachers. Students from low socio-economic areas perform less well on the auditory discrimination of sounds than do students from other socio-economic areas.

It appears that man's environment plays a significant role in developing his auditory perceptual abilities. This presents a promising future for the potential effects of enrichment programs for pre-school and first grade education designed to exterminate the vast differences between environmental backgrounds, particularly those of lower-class children.

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APPENDIX A

ADMINISTRATION OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

PART I

ADMINISTRATION OF THE FAST-COSENS AUDITORY DISCRIMINATION TEST

1. Each child was tested individually.

2. Each child faced the experimenter.

Following are the directions for administering the test.

Today we are going to play a game with words. In order to play this game, I will give you two words at a time, and you are to tell me if the words are the same or different. If I say the word twice, that is, if the second word is exactly the same as the first word, I want you to keep your hands on your lap- like this, (demonstrate for the child). If the words are different, that is, if you hear a change and the second word does not sound exactly like the first one, put your hand up - like this, (demonstrate for the child). Sometimes the words will rhyme, but they are not exactly the same.

Listen! I will give you two words and you are to tell me if they are the same or different, "wide", "ride". Are those the same or are they different? Show me! Yes, you are right, - the two words are different, so you lift up your hand.

Now let us try a few word pairs for practice, to make sure that you know how to play the game. (Give the examinee the practice items in Appendix A, Part II).

If after the practice items, a child still had trouble understanding the directions or the concept of 'same' and 'difference', additional practice items were given.

If the examinee understood the task, the test was ready to proceed.

I am going to switch on the tape recorder and see if you can play this game by listening to the words on the tape. Remember, if the words sound the same, you keep your hands on your lap. If the words sound different, you put your hand up high. All right! Are you ready? Listen carefully! Two word pairs were then played on the tape, "rack - rat, and bag - bag." The children were then asked to respond to these two word pairs. If no difficulty was observed by the investigator, the test was ready to proceed.

The tape was again started, and the next four word pairs (the rest of the practice items) were voiced on the tape, but not recorded by the investigator. This was to permit the examinee to get used to the rate and the intervals between word pairs as presented on the tape recording.

Appendix A, Part II consists of the Test items which were presented to each student.

FAST-COSENS AUDITORY DISCRIMINATION TEST

Practice Items

1. wide ride
2. thimble thimble
3. zip gyp
4. fell fell
5. nice knife
6. paint faint

Practice Items on Tape

1. rack rat
2. bag bag
3. cup cut
4. wide wide
5. slimmer slinger
6. lung rung

THE FAST-COSENS AUDITORY DISCRIMINATION TEST

1. witch wish
2. cap cap
3. bug bug
4. pleasure pledger
5. chin chin
6. seed seed
7. ring wing
8. first thirst
9. volt bolt
10. harsh harsh
11. shake shake
12. sheep cheap
13. reshine reshine
14. sink sink
15. lease leash
16. gaze gaze
17. red red
18. hash hatch
19. wed wed
20. dare dare
21. sheet sheet
22. pie thigh
23. raging raging
24. peeve peeve
25. slim sling
26. brimming brimming
27. nice nice
28. leap weep
29. breed breathe
30. wife wife
31. bad bag
32. thatch thatch
33. shape shape
34. had has
35. region reason
36. mess mess
37. cherry sherry
38. lath lash
39. by by
40. thine vine
41. tenth tenth
42. switches swishes
43. wishing wishing
44. chains change

45. swimming swinging
46. swim swim
47. elect erect
48. led led
49. boat boat
50. robe rode
51. clove clove
52. rocking rotting
53. van van
54. rash wrath
55. lap lap
56. muscle muffle
57. shack sack
58. range range
59. card card
60. lathe laid
61. shin shin
62. bathe bathe
63. then then
64. lath lass
65. day they
66. lit lit
67. way lay
68. legion legion
69. lash latch
70. by thy
71. cup cup
72. teething teething
73. bid bid
74. lesion legion
75. laid laid
76. simmer simmer
77. fought thought
78. ban van
79. wrath wrath
80. lass lash
81. sack sack
82. fearing feeling
83. roughing roughing
84. thought thought
85. thin thin
86. mesh mess
87. lap rap
88. rub rub
89. rap wrath
90. day day
91. popping potting
92. sherry sherry
93. thatch patch
94. ring ring

95. reason reason
96. has has
97. pick thick
98. grease grease
99. muff muff
100. ran rang
101. pie pie
102. peep peep
103. raising raging
104. push push
105. cheat sheet
106. bat bat
107. lit lick
108. leap leap
109. thy vie
110. cashing cashing
111. rains range
112. brimming bringing
113. slim slim
114. cad cad
115. clove clothe
116. waking waiting
117. vow vow
118. hearth harsh
119. rate rate
120. shake sake
121. page page
122. had had
123. bathe bade
124. thy thy
125. tenth tense
126. sing sing
127. dare there
128. lot lot
129. wait late
130. elect elect
131. pleasure pleasure
132. sinner sinner
133. mush muff
134. bath bath
135. shief thief
136. muss muff
137. cad cab
138. pushy pushy
139. cashing catching
140. reep reep
141. feeling feeling
142. grief grease

143. thorn thorn
144. waking waking
145. winning winging
146. popping popping
147. roughing rushing
148. clang clang
149. page pays
150. rate late
151. sun sung
152. thy thy
153. bail vale
154. rub rug
155. half hash
156. raft raft
157. fence thence
158. rung rum
159. cuffing cuffing
160. beater beaker
161. lot lock
162. peak peep
163. wing wing
164. naval naval
165. arriving arising
166. thy die
167. has have
168. lasses lashes
169. thigh thigh
170. fought fought
171. cog cob
172. hopper hotter
173. crutches crutches
174. bat that
175. pass pass
176. big bid
177. singer simmer
178. chat chap
179. lathe lave
180. dish dish
181. after aster
182. vow thou
183. sought thought
184. buzz buzz
185. wag rag
186. lashing laughing
187. closing clothing
188. late late
189. lens lend
190. lash lash

191. rising rising
192. wins wins
193. thank shank
194. rig rig
195. sheep sheath
196. latch latch
197. pup puff
198. winging winging
199. aster aster
200. witches wishes
201. web wed
202. lease lease
203. coke cope
204. puff puff
205. shoot shoot
206. laugh lash
207. sheep sheep
208. closing closing
209. leaf lease
210. thief thief
211. hash hash
212. beaker beaker
213. sinner singer
214. upper upper
215. refine reshine
216. swinging swinging
217. thin thin
218. gaze gave
219. lashing lashing
220. red led
221. win wing
222. tug tub
223. lasses lasses
224. clam clang
225. muffle muffle
226. lake late
227. shape shake
228. rack rack
229. thimble symbol
230. sung sung
231. arising arising
232. naval nasal
233. shot shop
234. peeve pease
235. hotter hotter
236. pussy pushy
237. first first
238. thence thence

239. bolt bolt
240. slitting slipping
241. switches switches
242. chat chat
243. thee be
244. mouse mouse
245. led leg
246. laugh laugh
247. rotting rotting
248. vale vale
249. sift shift
250. cap cat
251. lathe lathe
252. cuffing cussing
253. there there
254. sink think
255. raft waft
256. rising writhing
257. wind wins
258. wag wag
259. teething teasing
260. shin thin
261. cog cog
262. wreath reap
263. soak soak
264. wish wish
265. leap leaf
266. pass path

APPENDIX B

DIFFICULTY INDEX LEVEL FOR EACH SOUND COMPARISON AND THE AVERAGE DIFFICULTY INDEX LEVEL ON THE FAST-COSENS AUDITORY DISCRIMINATION TEST

DIFFICULTY INDEX LEVEL FOR EACH SOUND COMPARISON AND THE AVERAGE DIFFICULTY INDEX LEVEL ON THE FAST-COSENS AUDITORY DISCRIMINATION TEST

Speech Sound	Other Socio-Economic Status				Low Socio-Economic Status			
	Average Difficulty Index Level	Degree of Difficulty 8.5-1.00	7.5-8.4	0-.74	Average Difficulty Index Level	Degree of Difficulty .85-1.00	.75-.84	0-.74
STOPS: voiceless								
p-t (medial)								
popping-potting		.850						.650
hopper-hotter	.856	.917			.617			.700
slipping-slitting			.800					.500
p-t (final)								
cap-cat				.567				.467
shop-shot	.733	.850			.583			.683
chap-chat			.783					.500
p-k (final)								
peep-peek				.650				.550
cope-coke	.567			.567	.450			.350
shape-shake				.483				.450
t-k (medial)								
rotting-rocking			.783					.717
waiting-waking	.778			.717	.578			.650
beater-breaker			.833					.667
t-k (final)								
lot-lock		.867						.650
late-lake	.828		.784		.683			.700
lit-lock			.817					.700

STOPS: voiced								
d-g (final)								
bad-bag				.217				
bid-big	.825		.767		.725			.183
led-leg		.883				.850		.600
b-g (final)								
rub-rug			.750					.533
cob-cog	.639			.517	.422			.350
rub-tug								.383
rode-robe			.817					.633
cad-cab	.856	.917			.689		.783	
wed-web			.833					.650
NASALS								
n-g (medial)								
winning-winging				.700				.733
simmer-singer	.775	.850			.508			.583
n-ŋ (final)								
ran-rang		.850						.733
sun-sung	.644			.183	.517			.083
win-wing		.900						.733
m-ŋ (medial)								
swimming-swinging		.883						.650
brimming-bringing	.805		.750		.650			.617
simmer-singer			.783					.683

NASALS							
m-ŋ (final)							
slim-sling			.767				.617
rum-rung	.783			.717	.629		.567
clam-clang		.867					.700
GLIDES							
l-r (initial)							
lap-rap		.850					.733
late-rate	.884	.917			.711	.750	
led-red		.883					.540
l-r (medial)							
feeling-fearing		.900				.800	
elect-erect	.850		.800		.716		.633
w-l (initial)							
weep-leap			.750				
way-lay	.861	.900			.744		.733
wait-late		.933				.783	.717
w-r (initial)							
wing-ring		.100				.800	
wag-rag	.839	.867			.734		.633
waft-raft				.650		.767	
FRICATIVES: voiced							
v-ð (initial)							
vow-thou			.750				.550
vie-thy	.728			.617	.627		.600
vine-thine			.817				.733

FRICATIVES: voiced								
v-ð (final)								
clove-clothe	.242			.333	.175			.117
*lave-lathe				.150				.233
z-ð (medial)								
closing-clothing			.833					.350
rising-writhing	.844	.850			.539			.583
teasing-teething		.850						.683
v-z (medial)								
naval-nasal	.866	.850						.700
arriving-arising		.883			.725		.750	
v-z (final)								
have-has		.967				.850		
gave-gaze	.911	.917			.700			.600
peeve-pease		.850						.650
FRICATIVES: voiceless								
θ-f (initial)								
thirst-first			.783					.533
*thought-fought	.455			.550	.416			.600
*thence-fence				.033				.117
θ-s (initial)								
thought-sought		.883						
thimble-symbol	.889	.900			.700		.783	.667
think-sink		.883						.650

FRICATIVES: voiceless								
θ-s (final)								
path-pass				.717				.542
tenth-tense	.833	.850			.720		.750	
lath-loss		.933				.867		
s-f (medial)								
muscle-muffle		.883				.883		
aster-after	.850		.800		.828			.733
cussing-cuffing		.867				.867		
s-f (final)								
muss-muff		.900						.733
grease-grief	.911	.983			.761	.833		
lease-leaf		.850						.667
š-s (initial)								
shift-sift			.783				.750	
shake-sake	.844	.850			.789		.817	
shack-sack		.900					.800	
š-s (medial)								
lashes-lasses		.917			.775		.767	
pushy-pussy	.900						.783	
š-s (final)								
leash-lease				.333				.250
lash-lass	.689		.833		.572			.733
mesh-mess		.900						.733
š-θ (initial)								
shief-thief		.900				.867		
*shank-thank	.805			.733	.789	.867		
shin-thin			.783					.633

FRICATIVES: voiceless								
š-θ (final)								
lash-lath		.917				.900		
rash-wrath	.895	.900			.828		.767	
harsh-hearth		.867					.817	
š-f (medial)								
rushing-roughing		.983					.833	
lashing-laughing	.917	.917			.844	.883		
reshine-refine		.850					.817	
š-f (final)								
mush-muff		.933					.767	
hash-half	.900	.917			.778		.800	
lash-laugh		.850					.767	
AFFRICATES								
š-č (intial)								
sheep-cheap				.617				.400
sherry-cherry	.661			.583				.417
sheet-cheat			.783		.517			.733
š-č (medial)								
swishes-switches				.700				
cashing-catching	.795	.867			.750	.883		.583
wishes-witches			.817				.783	
š-č (final)								
wish-witch			.817					.700
hash-hatch	.867	.883			.667			.700
lash-latch		.900						.600
ǰ-z (medial)								
region-reason		.900					.817	
raging-raising	.917	.933			.817		.817	

AFFRICATES								
ǰ-z (final)								
range-rains			.750				.567	
change-chains	.811		.767		.667		.650	
page-pays		.917				.783		
ǰ-ž (medial)								
pledger-pleasure				.400	.734			.350
legion-lesion	.467			.533				.517
OTHER COMPARISONS								
vl stop with vl fricatives								
p-f (final)								
pup-puff	.783		.833					.717
leap-leaf				.733	.650			.583
p-θ (initial)								
pie-thigh		.883				.867		
path-thatch	.900	.900			.861	.883		
pick-thick		.917					.833	
p-θ (final)								
rap-wrath				.583				.450
sheep-sheath	.589			.433	.489			.367
reap-wreath			.750					.650
vd stops with vd fricatives								
v-b (initial)								
volt-bolt				.183				.167
van-ban	.566		.833		.472			.600
vale-bale				.683				.650

ud stops with vd fricatives								
ð-b (initial) thy-by that-bat thee-bee	.756	.900	.800	.567	.633		.817	.650 .433
z-d (final) has-had lens-lend wins-wind	.928	.933 .917 .933			.789		.817 .767 .783	
d-ð (initial) day-they dare-there die-thy	.917	.867 .933 .950			.783	.867	.783	.700
d-ð (final) breed-breathe laid-lathe bade-bathe	.750		.833 .800	.617	.550			.383 .633 .633

APPENDIX C

CORRESPONDENCE

LETTER SEEKING PERMISSION TO CARRY OUT THE STUDY

Edmonton, Alta.,
250 Pembina Hall,
March 20, 1968.

Dr. F. J. Gathercole,
Director of Education,
Public Schools and Collegiates,
Saskatoon, Sask.

Dear Dr. Gathercole:

I am a graduate student enrolled in the College of Elementary Education at the University of Alberta in Edmonton. The purpose of this letter is to seek permission to carry out a study in the Elementary School System, in connection with my Master's thesis. Should the permission for this work be granted, I should like to begin by May 1st. This would mean that I will have completed my research by May 17th.

Enclosed you will find a copy of my thesis proposal, "The Effect of Socio-Economic Status on the Development of Auditory Discrimination as it Relates to Reading Achievement." The purpose of the study is to compare the auditory discrimination of selected speech sounds of grade one students in low socio-economic areas with that of grade one students in other socio-economic areas and relate these results to reading achievement.

The entire first grade population of four schools in low socio-economic areas as well as the entire first grade population of children in four schools in other socio-economic areas will be included in this study. A test sample of sixty children in each socio-economic area will be selected using a table of random numbers. Each child will be tested individually by the experimenter and the entire process should take approximately one-half hour per child. Reading achievement scores will be analysed to determine the reading achievement level of each student.

It would be greatly appreciated, should permission to carry out this study in your system be obtained. A copy of the thesis will be made available to your office upon completion of the study.

Thanking you for your consideration, I remain,

Cordially yours,

(Sgd) "Dolores J. Fast"

MEMORANDUM TO PRINCIPALS CONFIRMING PERMISSION

TO CARRY OUT THE STUDY

Saskatoon Public Schools

MEMORANDUM:

TO: Principals of - Mayfair, Pleasant Hill, King George, Westmount, Greystone Heights, Brevoort Park, Hugh Cairns V.C., Lorne Haselton.

FROM: Director of Instruction

Miss Dolores Fast, presently on leave for study in Edmonton from our staff, has requested permission to carry on a research project in primary reading in our school system. In broad general terms, the research is built around the concept of the development of auditory discrimination in relation to reading achievement. I have assured her that she would get full cooperation from any members of our staff whom she would wish to include in the study.

Her plan is that she will try to carry out the testing aspects of the study between May 1 and 17. She will do all the testing herself and the scoring. All that she will require in any school is permission to take out Year 1 children one at a time for an individual test. Teachers will not be required to administer or score the tests.

If you have any conflict which would make it impossible for Miss Fast to carry on her study in any of the above mentioned schools would you please telephone me immediately so that a change can be made.

ACH:dl
March 25, 1968

A. Clare Hume,
DIRECTOR OF INSTRUCTION.

APPENDIX D

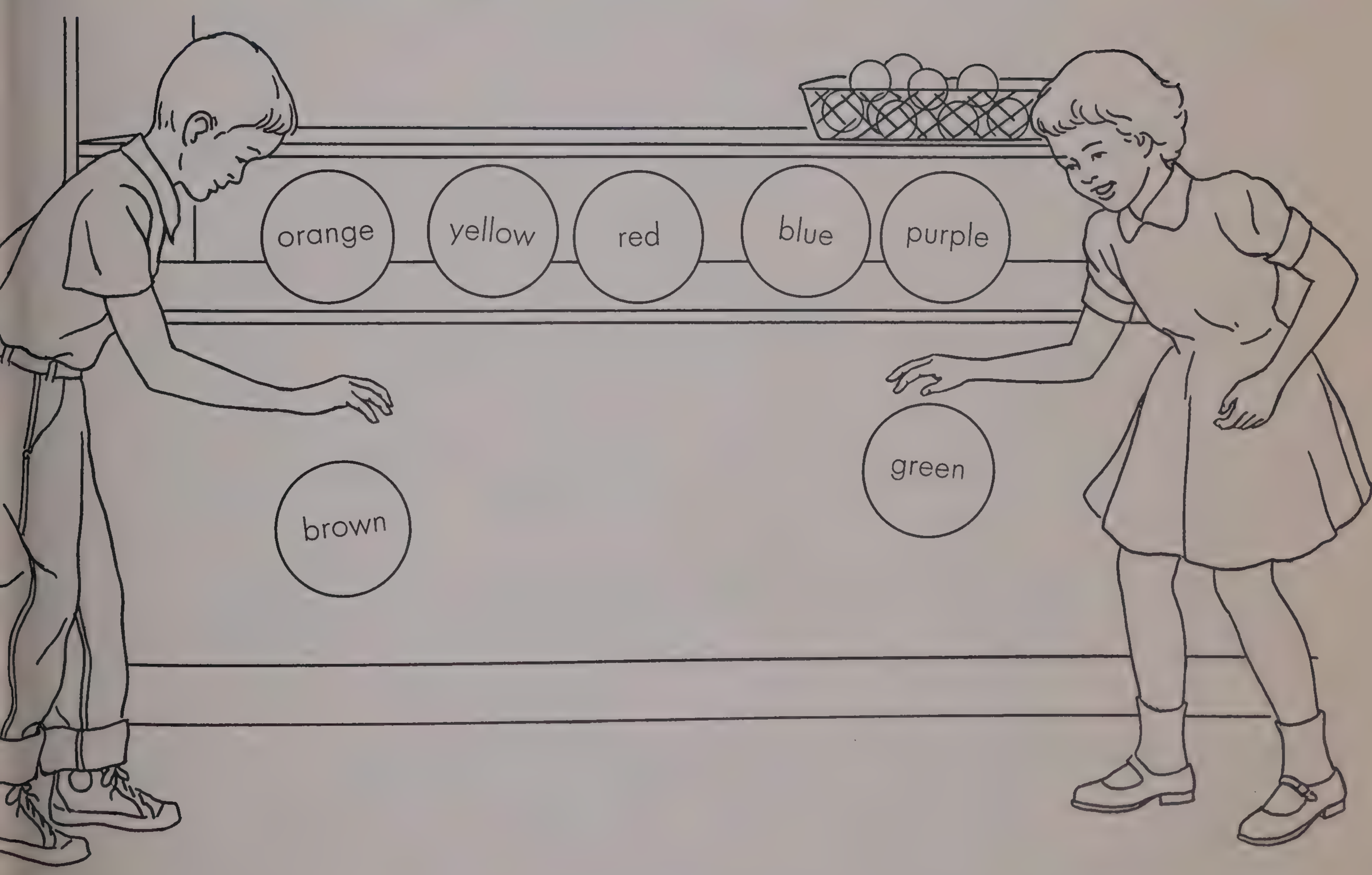
METROPOLITAN READING ACHIEVEMENT TEST

PRIMARY I, FORM B

FORM B

PRIMARY I BATTERY

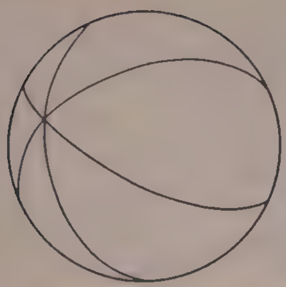
Metropolitan Achievement Tests



My name ______________________________

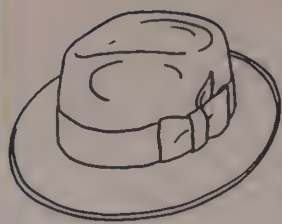
Harcourt, Brace & World, Inc.

TEST 1 Word Knowledge



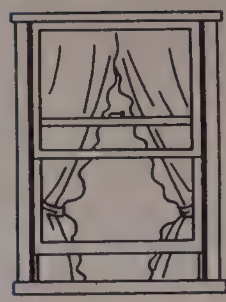
- [ ] pretty
- [ ] here
- [x] ball
- [ ] be

1



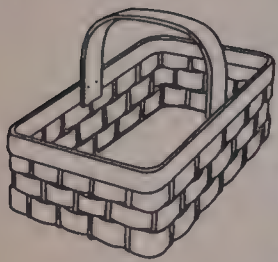
- [ ] he
- [ ] hat
- [ ] as
- [ ] boat

2



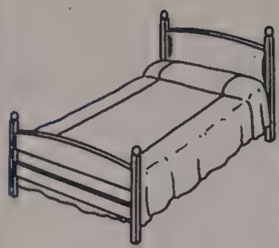
- [ ] what
- [ ] black
- [ ] corn
- [ ] window

3



- [ ] basket
- [ ] blue
- [ ] not
- [ ] monkey

4



- [ ] bed
- [ ] by
- [ ] yes
- [ ] two

5

- [ ] must
- [ ] fox
- [ ] monkey
- [ ] with

6

- [ ] tell
- [ ] year
- [ ] mother
- [ ] train

7

- [ ] hop
- [ ] hen
- [ ] us
- [ ] ball

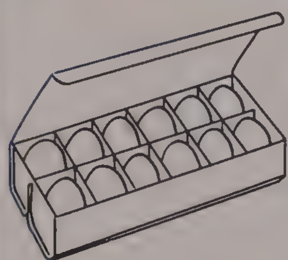
8

- [ ] cake
- [ ] put
- [ ] coming
- [ ] home

9

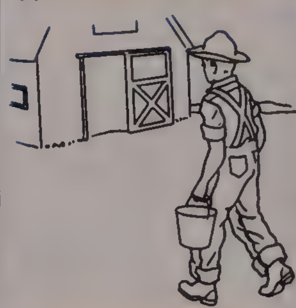
- [ ] party
- [ ] pet
- [ ] three
- [ ] farm

10



- [ ] every
- [ ] under
- [ ] eggs
- [ ] sleep

11



- [ ] fast
- [ ] three
- [ ] farmer
- [ ] policeman

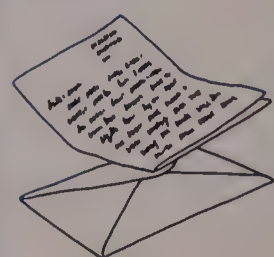
12

- [ ] made
- [ ] again
- [ ] story
- [ ] man

13

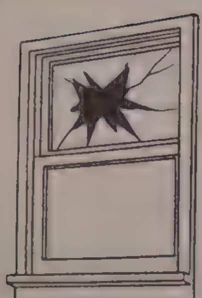
- [ ] street
- [ ] soon
- [ ] your
- [ ] kitten

14



- [ ] land
- [ ] most
- [ ] spy
- [ ] letter

15



- [ ] only
- [ ] broken
- [ ] baby
- [ ] ever

16

- [ ] from
- [ ] and
- [ ] fly
- [ ] box

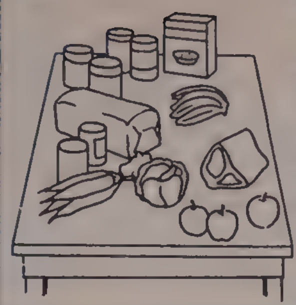
17

- [ ] mind
- [ ] king
- [ ] knees
- [ ] perhaps

GO ON TO THE NEXT PAGE

- ☐ whistle
- ☐ clothes
- ☐ cage
- ☐ small

19



- ☐ first
- ☐ food
- ☐ middle
- ☐ through

20

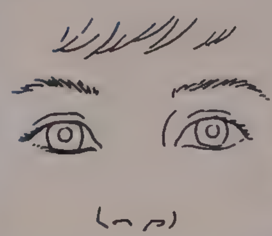
- ☐ brought
- ☐ happen
- ☐ almost
- ☐ hair

- ☐ hide
- ☐ milk
- ☐ hello
- ☐ five

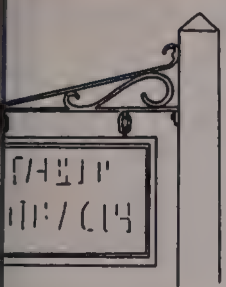
22

- ☐ soap
- ☐ question
- ☐ except
- ☐ silver

23



- ☐ lion
- ☐ enough
- ☐ eyes
- ☐ sea

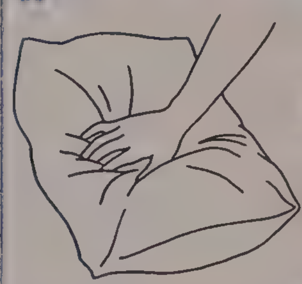


- ☐ should
- ☐ bring
- ☐ third
- ☐ sign

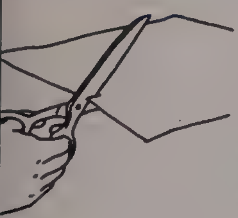
25

- ☐ string
- ☐ dinner
- ☐ dance
- ☐ apartment

26

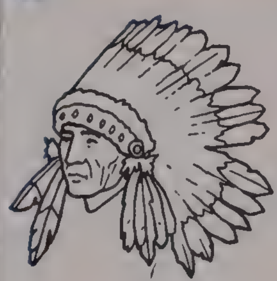


- ☐ soft
- ☐ even
- ☐ storm
- ☐ own



- ☐ slowly
- ☐ cut
- ☐ keep
- ☐ care

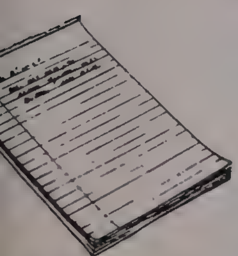
28



- ☐ attic
- ☐ crept
- ☐ chief
- ☐ event

29

- ☐ beauty
- ☐ matter
- ☐ meet
- ☐ hook

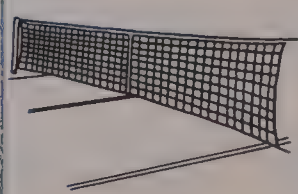


- ☐ side
- ☐ pond
- ☐ noise
- ☐ paper

31

- ☐ last
- ☐ tent
- ☐ lunch
- ☐ owl

32



- ☐ creatures
- ☐ needle
- ☐ instead
- ☐ net

- ☐ brook
- ☐ burn
- ☐ each
- ☐ tried

34

- ☐ afternoon
- ☐ frighten
- ☐ follow
- ☐ world

35

- ☐ agree
- ☐ path
- ☐ pleasant
- ☐ coffee

WORD KNOWLEDGE SCORE ______

DO NOT TURN PAGE

TEST 2 Word Discrimination

A	SAMPLE	some	☐	1	dig	☐	2	red	☐
		came	☐		did	☐		and	☐
		come	☒		dot	☐		send	☐
		could	☐		day	☐		said	☐
B	3	this	☐	4	took	☐	5	hour	☐
		his	☐		look	☐		you	☐
		then	☐		book	☐		your	☐
		thin	☐		hook	☐		our	☐
C	6	tall	☐	7	hat	☐	8	goat	☐
		bell	☐		sat	☐		boat	☐
		well	☐		fat	☐		coat	☐
		fell	☐		cat	☐		out	☐
D	9	house	☐	10	make	☐	11	often	☐
		mouse	☐		cake	☐		only	☐
		home	☐		take	☐		open	☐
		mouth	☐		took	☐		once	☐
E	12	drown	☐	13	fox	☐	14	bring	☐
		brown	☐		for	☐		string	☐
		room	☐		box	☐		thing	☐
		broom	☐		far	☐		spring	☐
F	15	better	☐	16	three	☐	17	fine	☐
		kettle	☐		them	☐		fire	☐
		little	☐		there	☐		five	☐
		letter	☐		they	☐		find	☐

GO ON TO THE NEXT PAG

save	19 store	20 chicken
same	stone	kitchen
some	stove	sicken
came	story	thicken
arm	22 wish	23 dream
army	with	crown
am	which	cream
are	will	clean
dish	25 black	26 bat
fist	back	bet
first	bake	bag
fish	break	bit
eggs	28 button	29 picture
eyes	better	picked
eats	bottle	pitcher
ears	butter	picket
harness	31 hunt	32 must
dangers	hurt	much
harken	hard	moss
darkness	bent	most
knit	34 after	35 flush
kite	over	flash
knife	often	clash
knight	offer	flesh

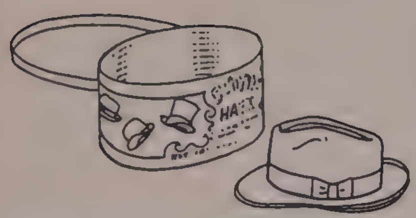
WORD DISCRIMINATION SCORE ________

STOP DO NOT TURN PAGE

SAMPLE

- [ ] The fruit is in a dish.
- [x] Here is some fruit.
- [ ] The fruit is on the tree.

1

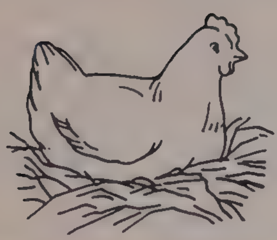


- [ ] There are pictures on the cover.
- [ ] A man's hat is beside the box.
- [ ] A woman's hat is in the box.

2

- [ ] It is a hot day.
- [ ] Father wears his coat.
- [ ] The man works at night.

3

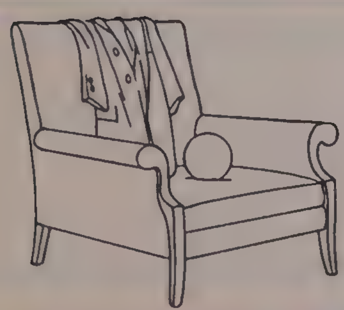


- [ ] The hen looks for some food.
- [ ] The baby chickens like their mother.
- [ ] Mother Hen sets on her nest.

4

- [ ] The pony runs to meet the boy.
- [ ] The boy is trying to find the pony.
- [ ] See all the ponies run to the boy.

5



- [ ] Fran threw her ball under the chair.
- [ ] Father left his coat on the chair.
- [ ] The children have put their toys away.

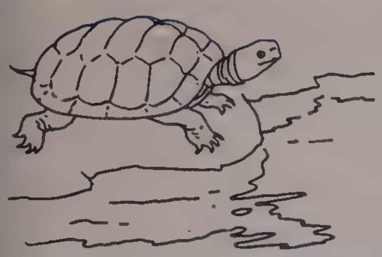
6

- [ ] There are two mother hens with the chicks.
- [ ] You can find just four chicks here.
- [ ] The baby chicks run away from their mother.

☐ The mailman comes up the walk.

☐ The boy goes to meet the mailman.

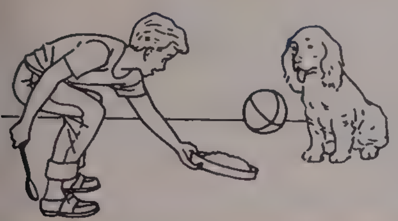
☐ The mailman gives the boy a letter.



☐ The turtle is having fun swimming.

☐ The turtle sits on a rock.

☐ The turtle has gone to sleep.



☐ Charles gives his puppy some food.

☐ The puppy plays ball with Charles.

☐ The ball and the spoon are in the dish.

☐ The kitten reaches for the big rubber ball.

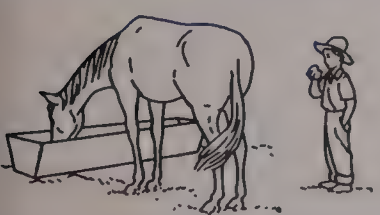
☐ The dish of milk is what the kitten wants most.

☐ The kitten likes best to play with yarn.

☐ The flock of birds flies over the trees.

☐ The birds are building nests in the trees.

☐ The flock of birds is on the ground.



☐ The horse eats the apple which the boy has given him.

☐ The boy eats his apple as he watches the horse.

☐ The boy and the horse both take a drink of water.

☐ The boys fly the kite over the fence.

☐ The kite is high in the air above the boys.

☐ The tail of the kite is caught in the fence.

STOP DO NOT TURN PAGE

SAMPLE I can fly.
I can sing.
I have a nest.
▶ Who am I?

☐ a girl ☒ a bird ☐ a dog

14 I am an animal.
I live on a farm.
I give you milk.
▶ Who am I?

☐ a horse ☐ a cow ☐ a dog

15 Sometimes it is big.
People ride on it.
It always rides on water.
▶ What is it?

☐ a boat ☐ a car ☐ a fish

16 I climb trees.
I have a bushy tail.
I like to eat nuts.
▶ Who am I?

☐ a squirrel ☐ a monkey ☐ a rabbit

17 Sometimes you open it.
Sometimes you close it.
You use it in the rain.
You put it over your head.
▶ What is it?

☐ a flag ☐ rubbers ☐ an umbrel

18 It has four legs.
It does not walk.
You go to it at night.
You sleep on it.
▶ What is it?

☐ a bed ☐ a chair ☐ a house

19 Children like it.
It is good to eat.
It is cold.
It is eaten at parties.
▶ What is it?

☐ cake ☐ candy ☐ ice cream

20 Father works for it.
He keeps it in his pocket.
It jingles.
It buys things.
▶ What is it?

☐ money ☐ a marble ☐ candy

21 My suit is red.
Children like me.
I bring them toys.
I come at Christmas.
▶ Who am I?

☐ the mailman ☐ Santa Clau
☐ the Easter Bunny

STOP

MPLE Look, Tom.
See the toy car.
It is a big car.

A The toy is a —

☒ car ☐ drum ☐ box

B Someone asked Tom to —

☐ play ☐ come ☒ look

---

ere, Blacky.
it, Blacky. Sit up.
ere is some meat.
e a good dog.
it up for the meat.

22 Blacky is a —

☐ cat ☐ dog ☐ pony

23 Someone wants Blacky to —

☐ sit up ☐ run ☐ walk

24 Blacky will eat some —

☐ bones ☐ meat ☐ cookies

---

ome, Ted. Run to Father.
un, Ted. You can run.
ome, get your present.
ome, get the football.
ome to Father and get your football.

25 Someone tells Ted to —

☐ walk ☐ go ☐ run

26 Father gives Ted a —

☐ football ☐ baseball ☐ airplane

27 Ted has a —

☐ present ☐ fall ☐ race

---

ook at the little girl.
he has a doll.
he has some cloth.
he cuts the cloth.
hen she sews it.
he doll will have a dress.

28 The little girl makes a —

☐ hat ☐ coat ☐ dress

29 It is for her —

☐ sister ☐ cat ☐ doll

30 First, the little girl —

☐ cuts ☐ sews ☐ paints

Some men built a new house.
A family came to live in it.
There were two boys.
There was a girl.
There was no dog.
But there was a cat.

31 Who made the house?
- [ ] a family
- [ ] boys
- [ ] men

32 They made it for —
- [ ] a family
- [ ] two boys
- [ ] anima

33 In the house lived two —
- [ ] boys
- [ ] dogs
- [ ] girls

34 How many animals lived in th house?
- [ ] three
- [ ] one
- [ ] two

We went to the zoo.
We saw funny monkeys.
We saw big elephants.
They played with water.
We saw big tigers and lions.
They made lots of noise.

35 The children went to the —
- [ ] zoo
- [ ] circus
- [ ] show

36 The monkeys were —
- [ ] big
- [ ] funny
- [ ] loud

37 Who played with water?
- [ ] the lions
- [ ] the tigers
- [ ] the elephants

38 The lions were —
- [ ] small
- [ ] friendly
- [ ] noisy

Aunt Helen went on a trip.
She got presents for the children.
Baby's present was a rattle.
Ellen got a doll.
Jim got a top.
Aunt Helen always brings presents home.

39 Aunt Helen got the presents —
- [ ] on a trip
- [ ] on a walk
- [ ] at work

40 Ellen's present was a —
- [ ] doll
- [ ] ball
- [ ] game

41 Who brings presents?
- [ ] Jim
- [ ] Ellen
- [ ] Aunt Helen

GO ON TO THE NEXT PAG

eorge lived on a farm.
is father drove a tractor on the farm.
ometimes Father let George steer he tractor.
ne day George got on the tractor all y himself.
e pushed some buttons.
he tractor started to go forward.
eorge pushed hard with his feet.
he tractor stopped. George was fraid.
e could steer the tractor, but he id not want to drive it until he was lder.

42 George's father was a —

- [ ] farmer
- [ ] truck driver
- [ ] grocer

43 George's father let him —

- [ ] drive the tractor
- [ ] steer the tractor
- [ ] pull the tractor

44 How did George start the tractor?

- [ ] He pushed some buttons.
- [ ] He turned the key.
- [ ] He asked Father to help.

45 When will George drive the tractor again?

- [ ] in the summertime
- [ ] when he is older
- [ ] when he feels better

READING SCORE________

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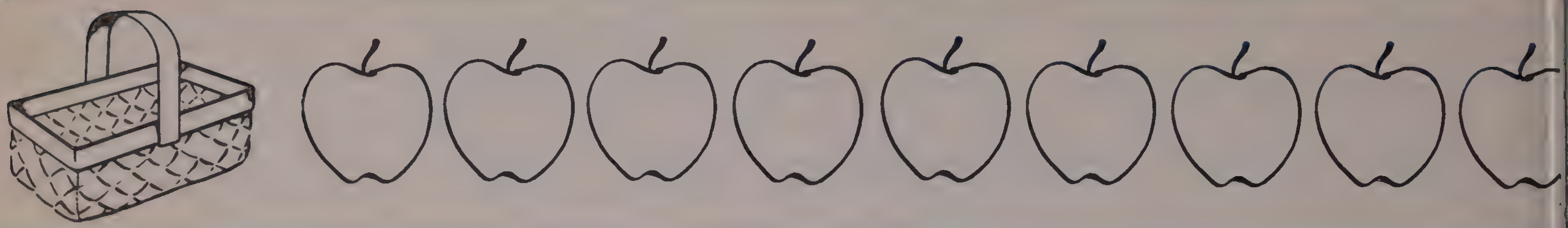

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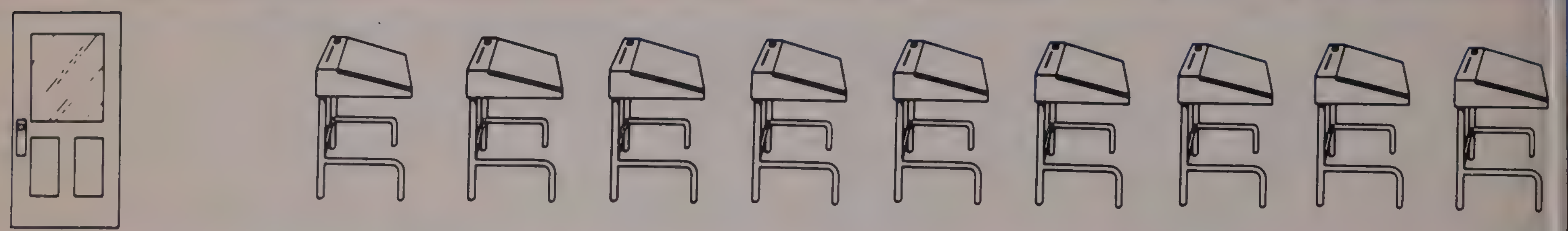

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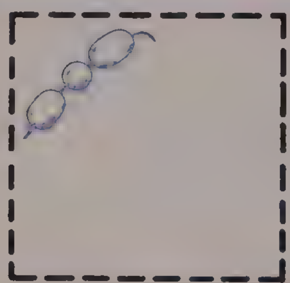

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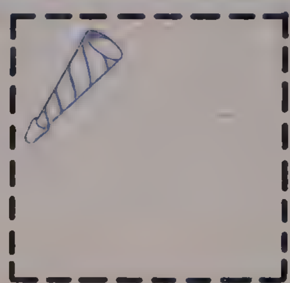

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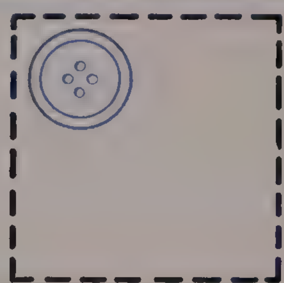

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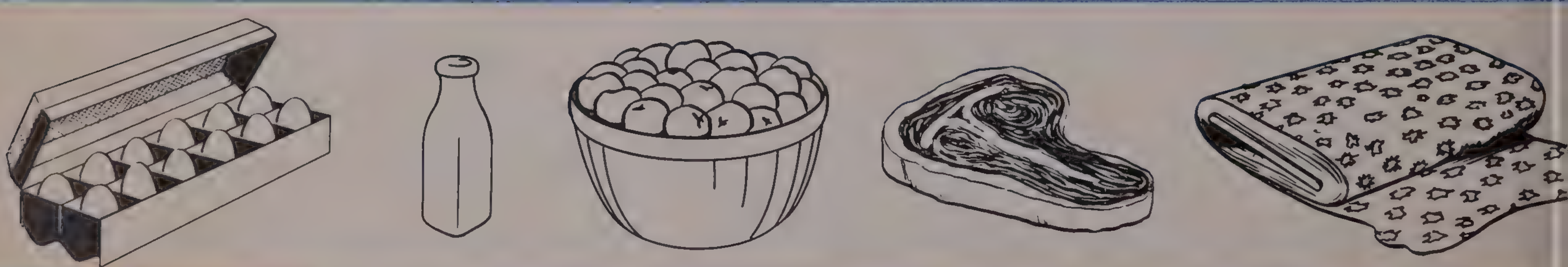

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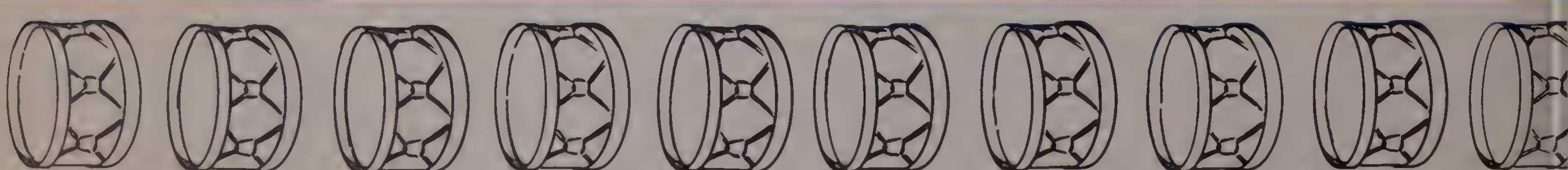

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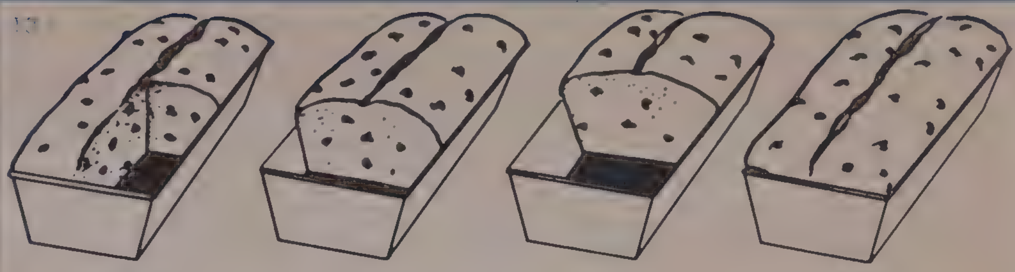

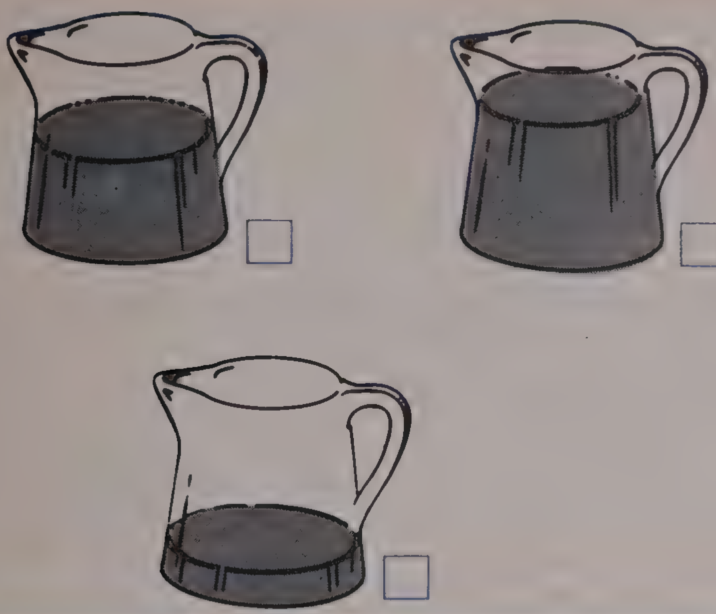

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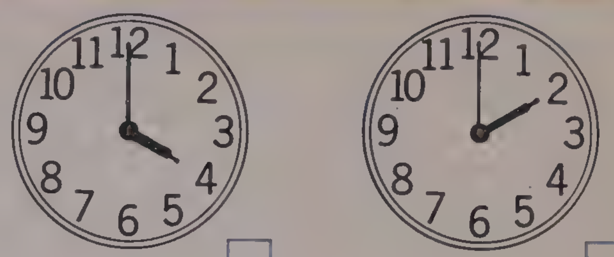

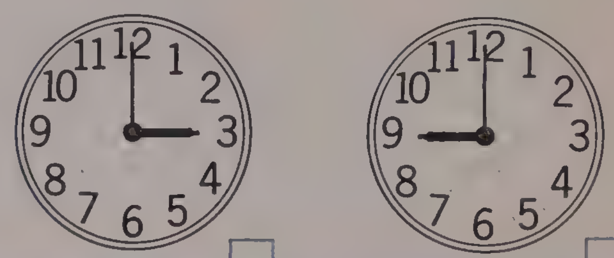

12 16 19 26

17

6 8 9 10

64 36 46 76

19

B

27 127 113 137

13 6 26 15

21

9 10 11 13

2 4 6 8

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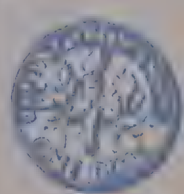


8 10 12 14

24
A

4	5	6	8	10
☐	☐	☐	☐	☐

25
B

5	6	7	8	9
☐	☐	☐	☐	☐

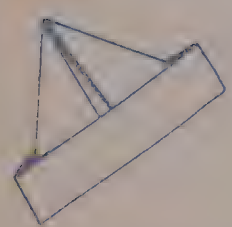
26
C

3	4	5	6	7
☐	☐	☐	☐	☐

27
D

2	3	4	5	6
☐	☐	☐	☐	☐

28



5	6	8	9	10
☐	☐	☐	☐	☐

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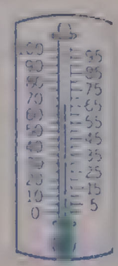

81	53	99	71	65
☐	☐	☐	☐	☐

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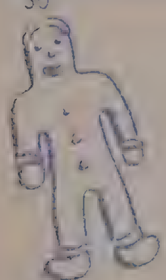

9	10	11	12	14
☐	☐	☐	☐	☐

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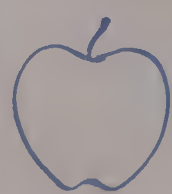

3	4	6	8	9
☐	☐	☐	☐	☐

32

2	3	4	5	6
☐	☐	☐	☐	☐

33

7	8	9	10	12
☐	☐	☐	☐	☐

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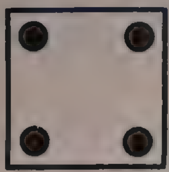
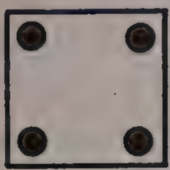
 and  are ☐

35

B  and  are ☐

 and  are ☐

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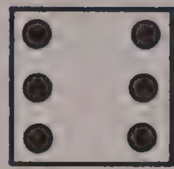
D  and  are ☐

 take away  = ☐

39

F  take away  = ☐

	41	42	43	44	45
$1 + 1$	$1 + 5$	$2 + 2$	$1 + 4$	$2 + 1$	$2 + 4$

	47	48	49	50	51
$1 + 7$	$5 + 2$	$1 + 3$	$4 + 0$	$3 + 2$	$4 + 3$

	53	54	55	56	57
$6 + 2$	$5 + 0$	$4 + 2$	$5 - 1$	$4 - 2$	$5 - 0$

	59	60	61	62	63
$6 - 3$	$4 - 3$	$7 - 6$	$8 - 5$	$5 - 3$	$6 - 4$

ARITH. CONCEPTS & SKILLS SCORE ________

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FORM B / PRIMARY I BATTERY

Metropolitan Achievement Tests

NAME ______________________________
Last Name First Name Initi

BOY ☐ GIRL ☐ GRADE __________ TEACHER ______________________

SCHOOL ______________________ DATE OF TESTING ______________________
Year Month D

CITY OR TOWN ______________________ DATE OF BIRTH ______________________
Year Month D

STATE ______________________ AGE ______________________
Years Months

SCORE BOX

TEST	WORD KNOWLEDGE	WORD DISCRIMINATION	READING	ARITHMETIC CONCEPTS AND SKILLS
RAW SCORE				
STAND. SCORE				
STANINE				
GRADE EQUIV.				
%-ILE RANK				

Harcourt, Brace & World NEW YORK

9101112A3

APPENDIX E

LORGE-THORNDIKE INTELLIGENCE TEST

LEVEL 1, FORM A, PRIMARY BATTERY

9-69369

EVEL 1 • FORM A • PRIMARY BATTERY

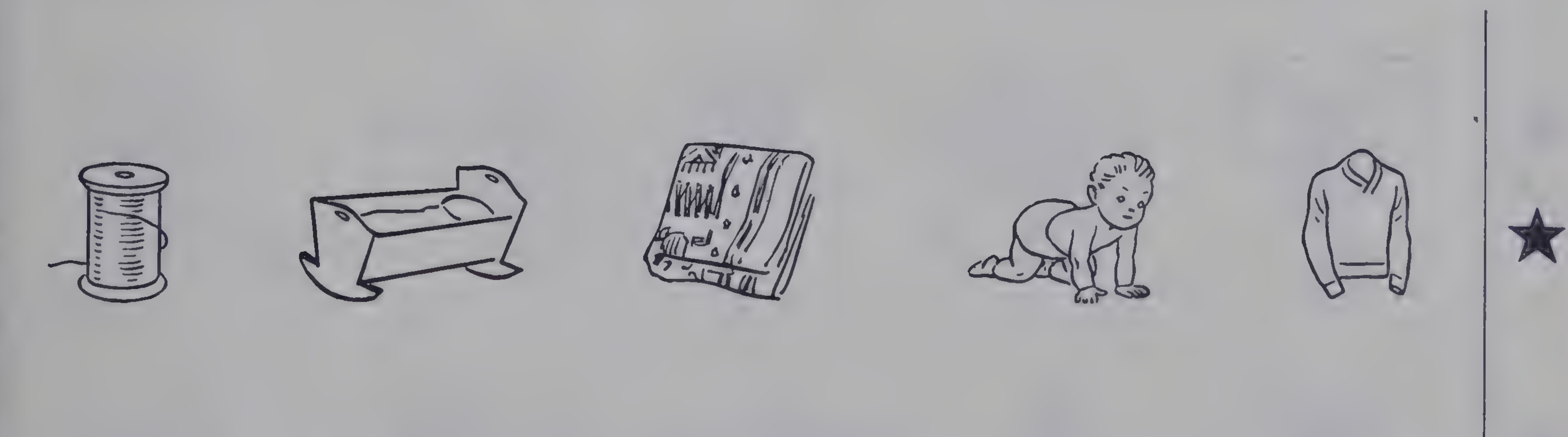
SCORE	
TEST 1	________
2	________
3	________
TOTAL	________
CA	________
DIQ	________

E ______________________ BOY or GIRL (circle one)
Last First Middle

DE ______ SCHOOL ______________________ DATE OF TEST ______________
Year Month Day

______________________ AGE ______________ DATE OF BIRTH ______________
Years Months Year Month Day

THE LORGE-THORNDIKE INTELLIGENCE TESTS



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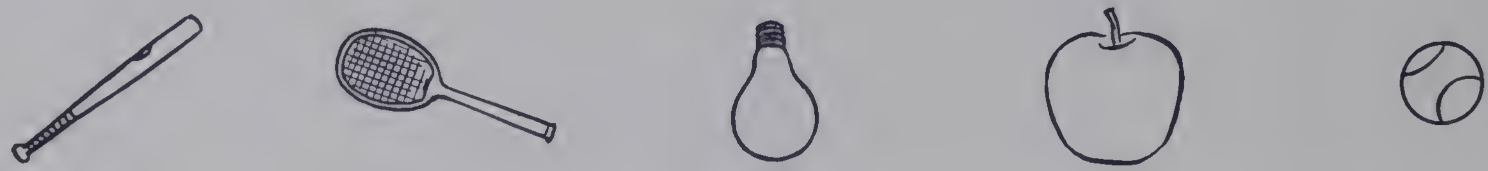

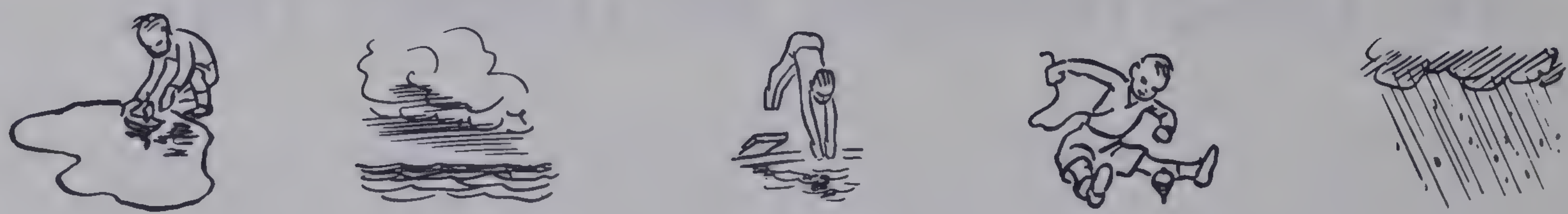

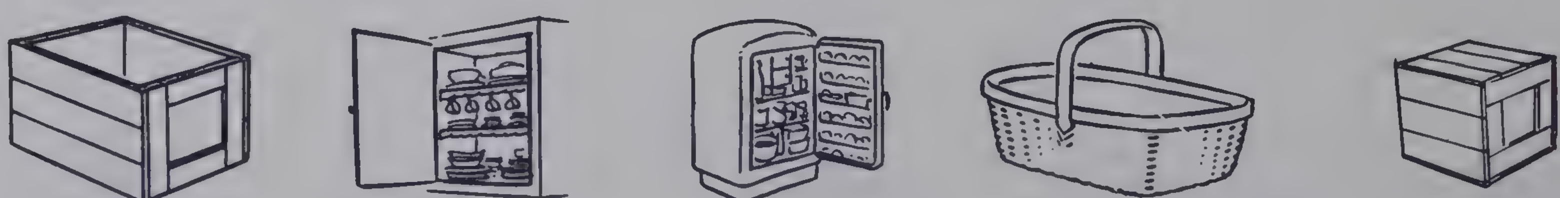

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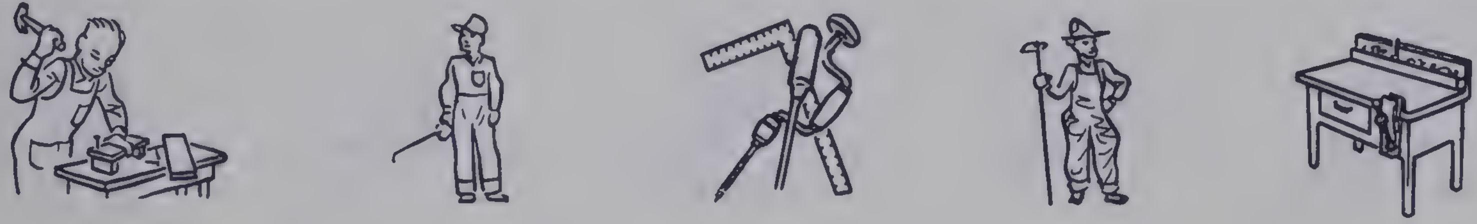

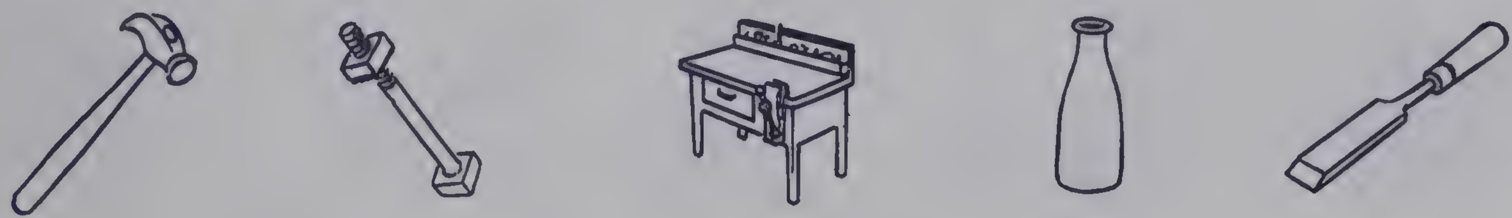

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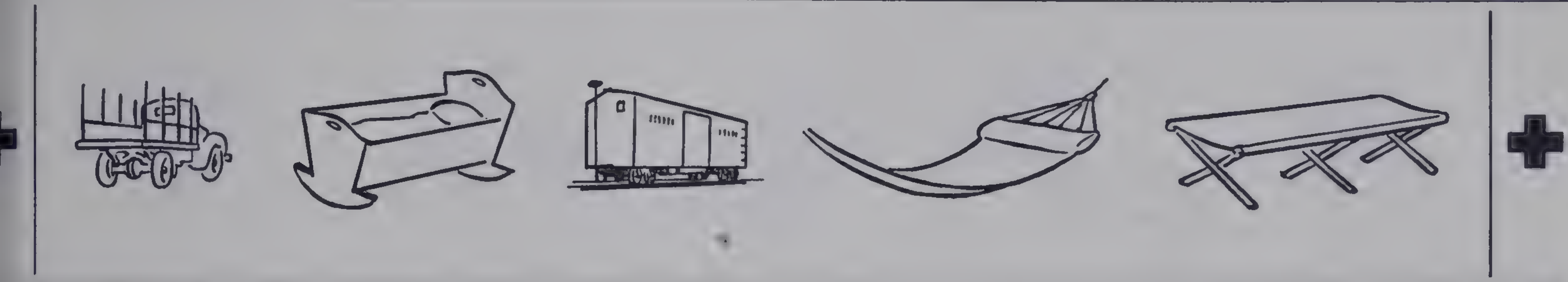

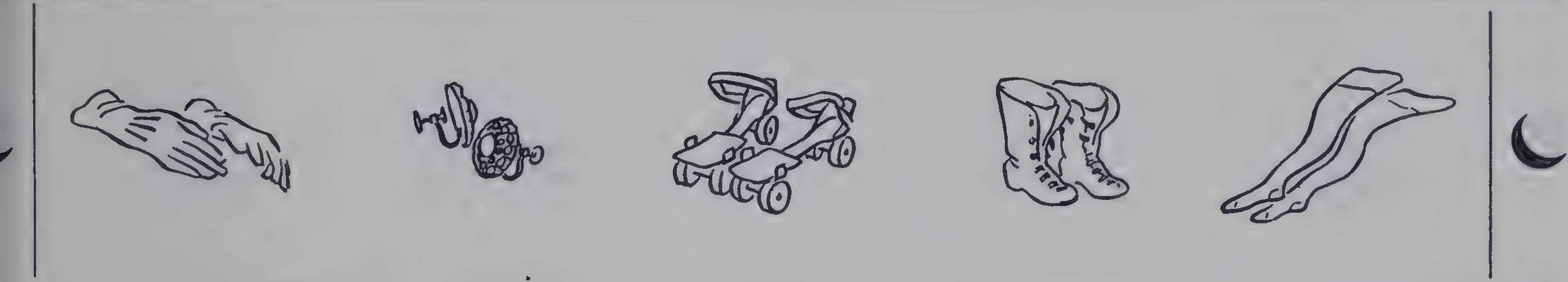

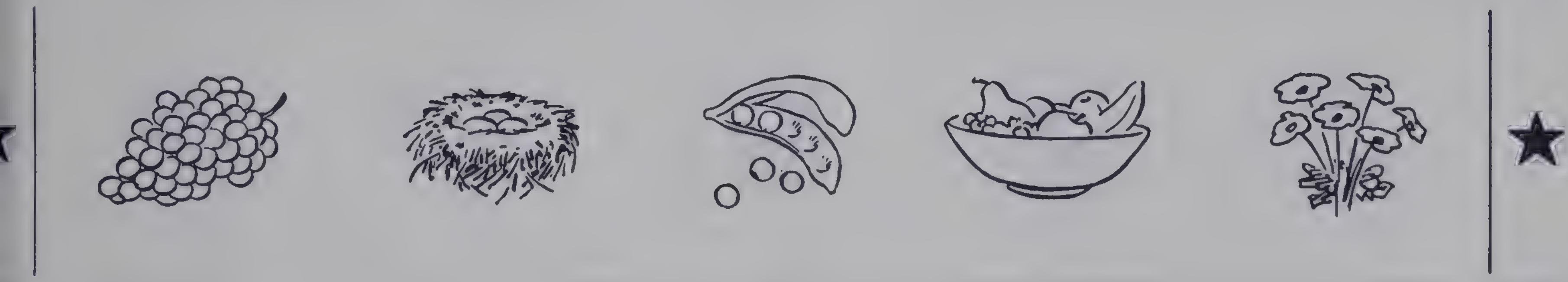

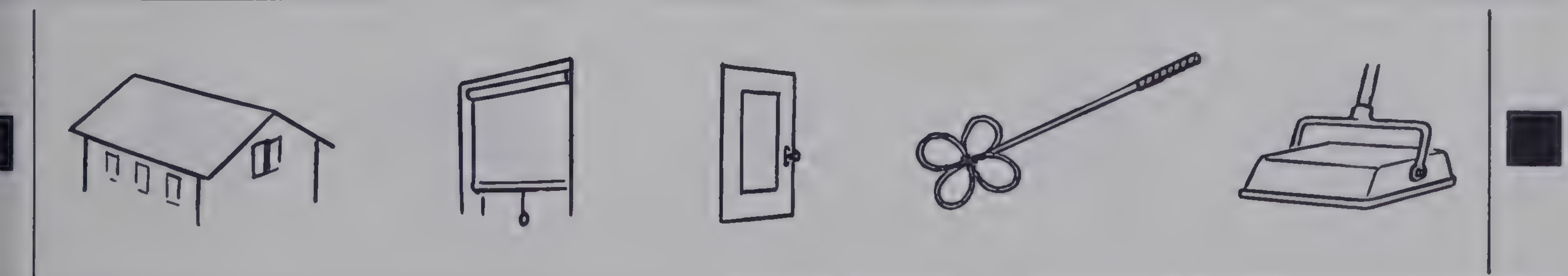

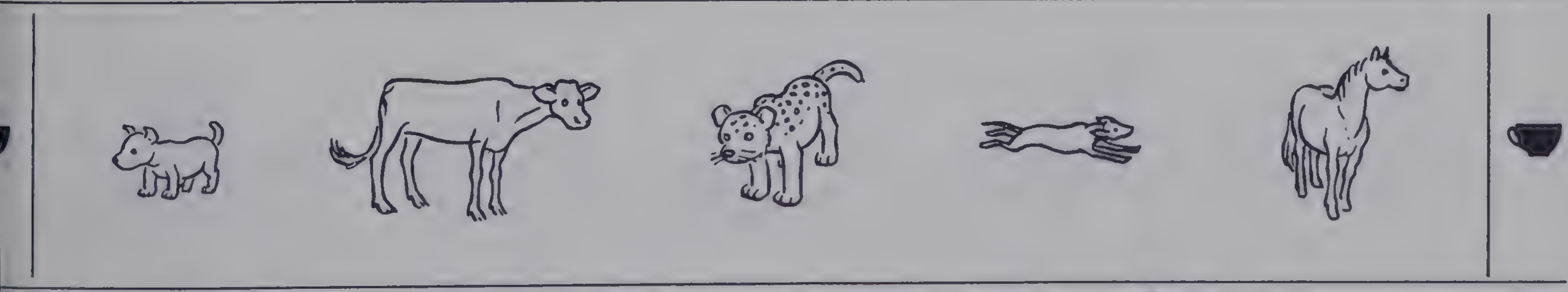

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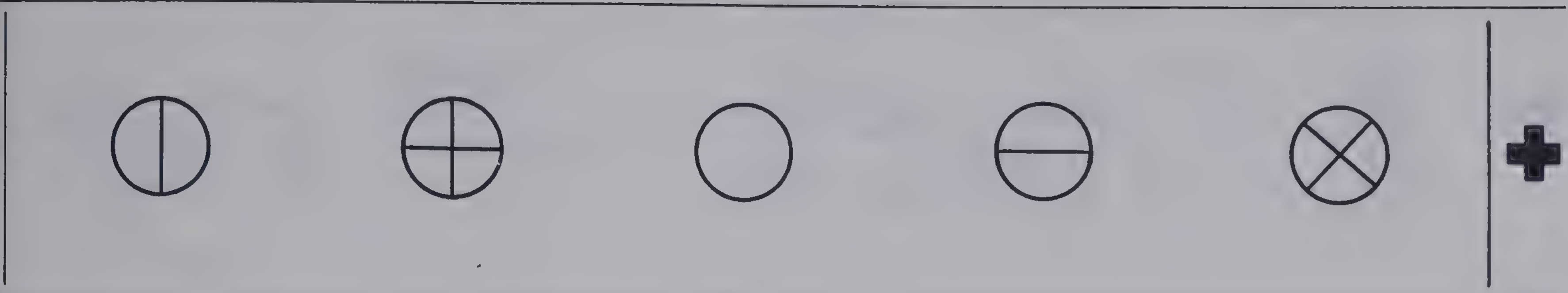

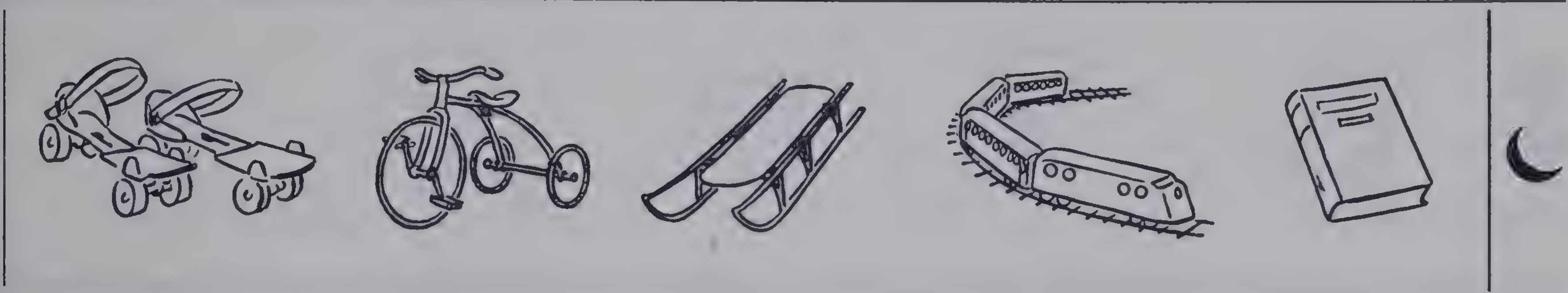

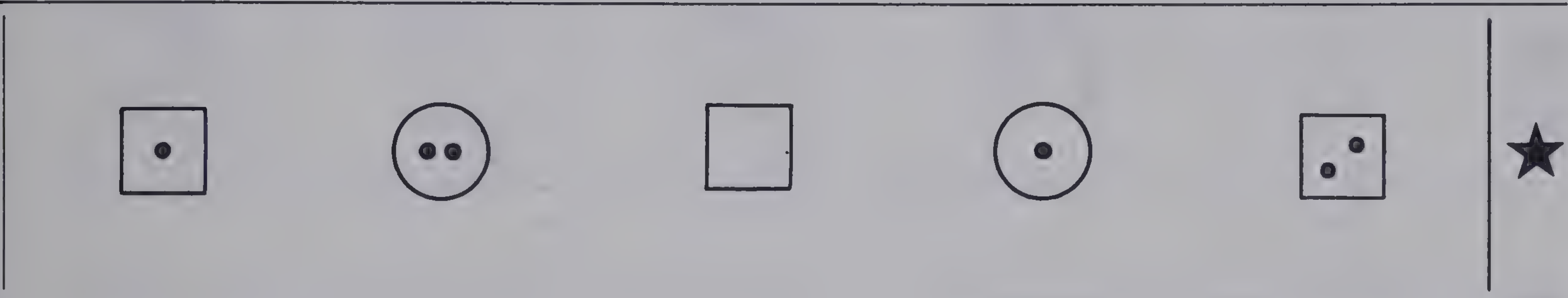

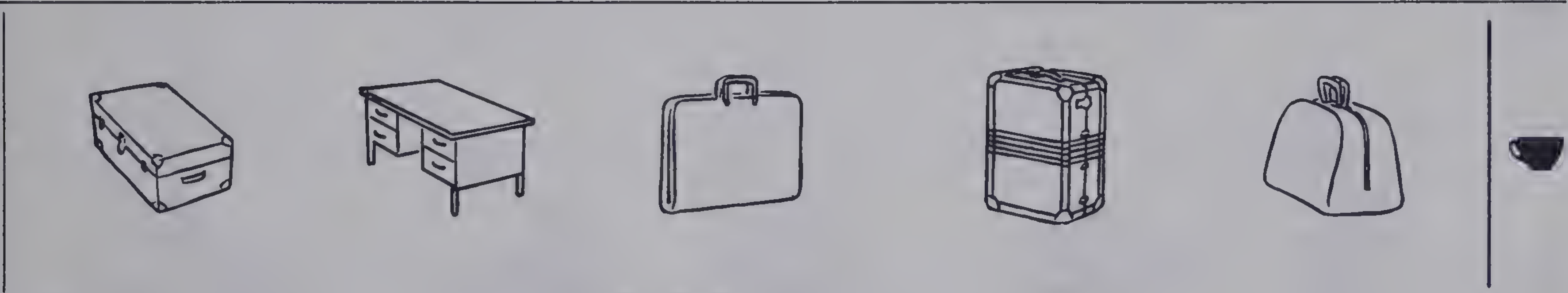

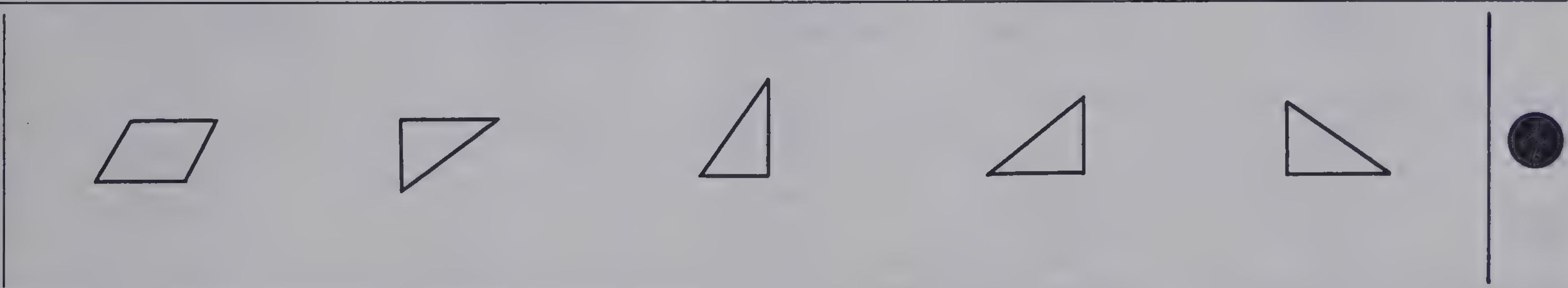

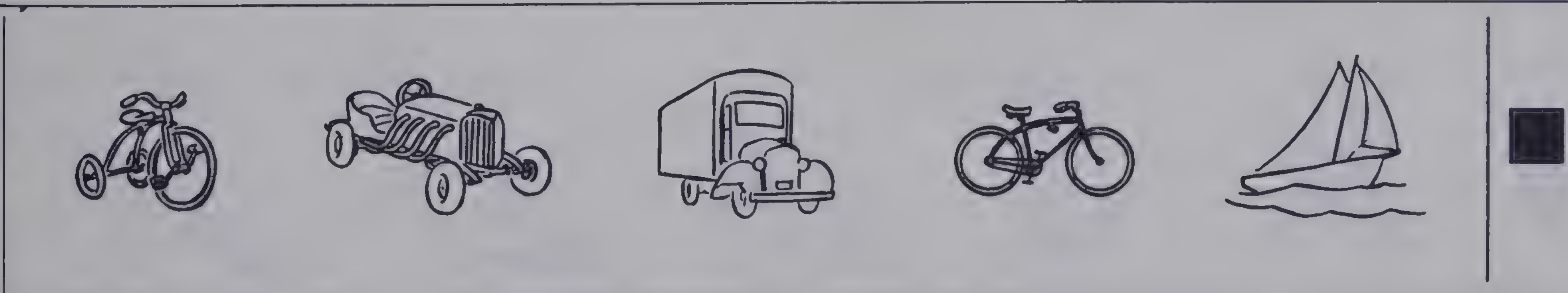

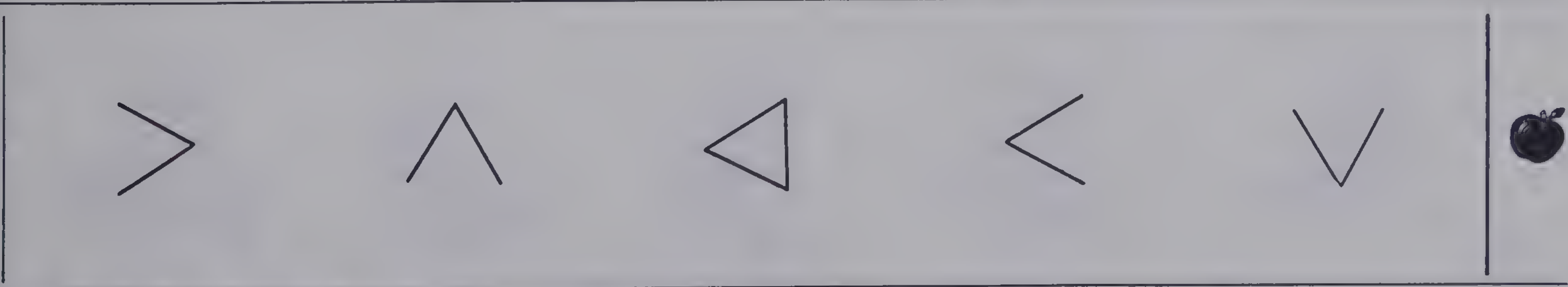

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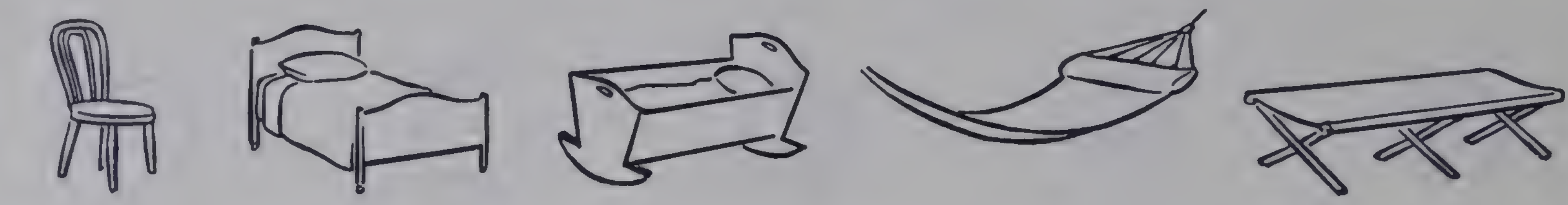

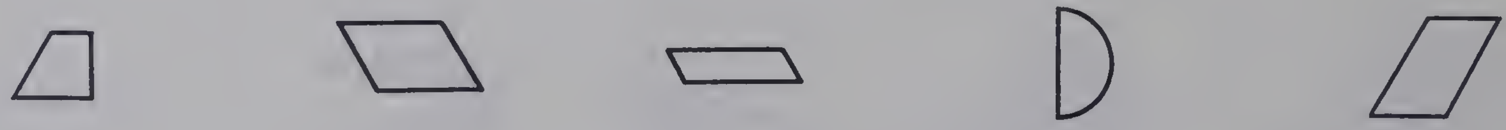

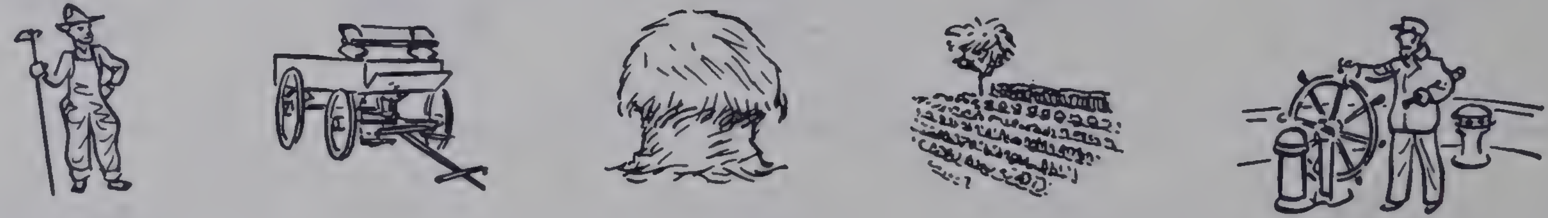

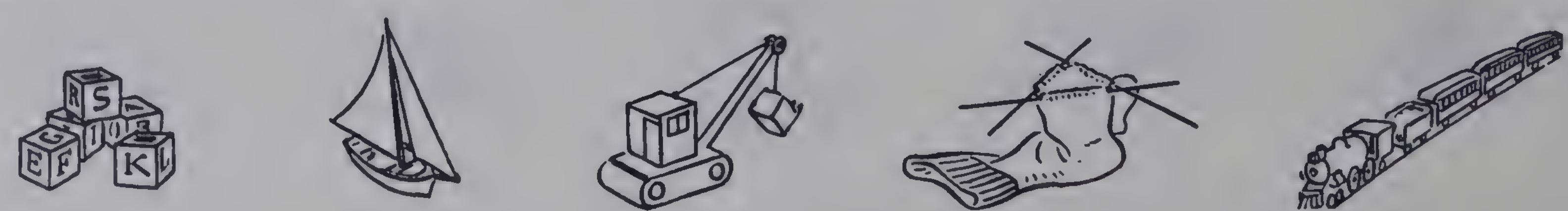

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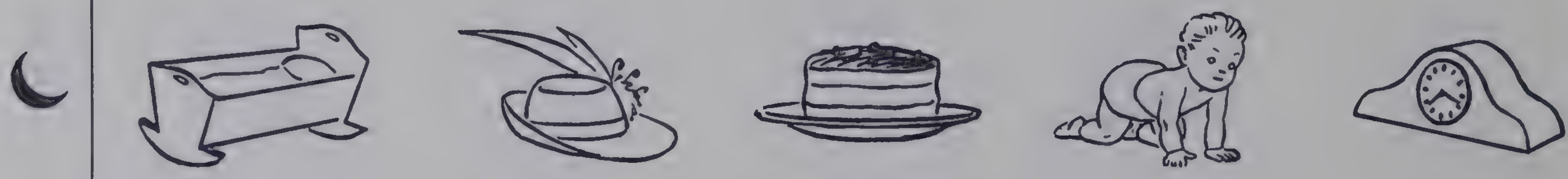


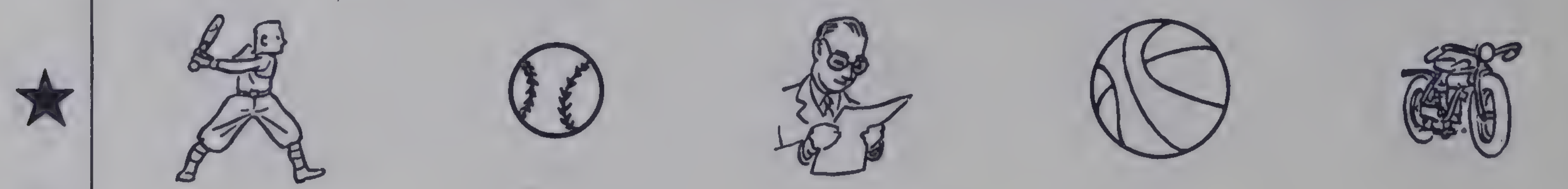

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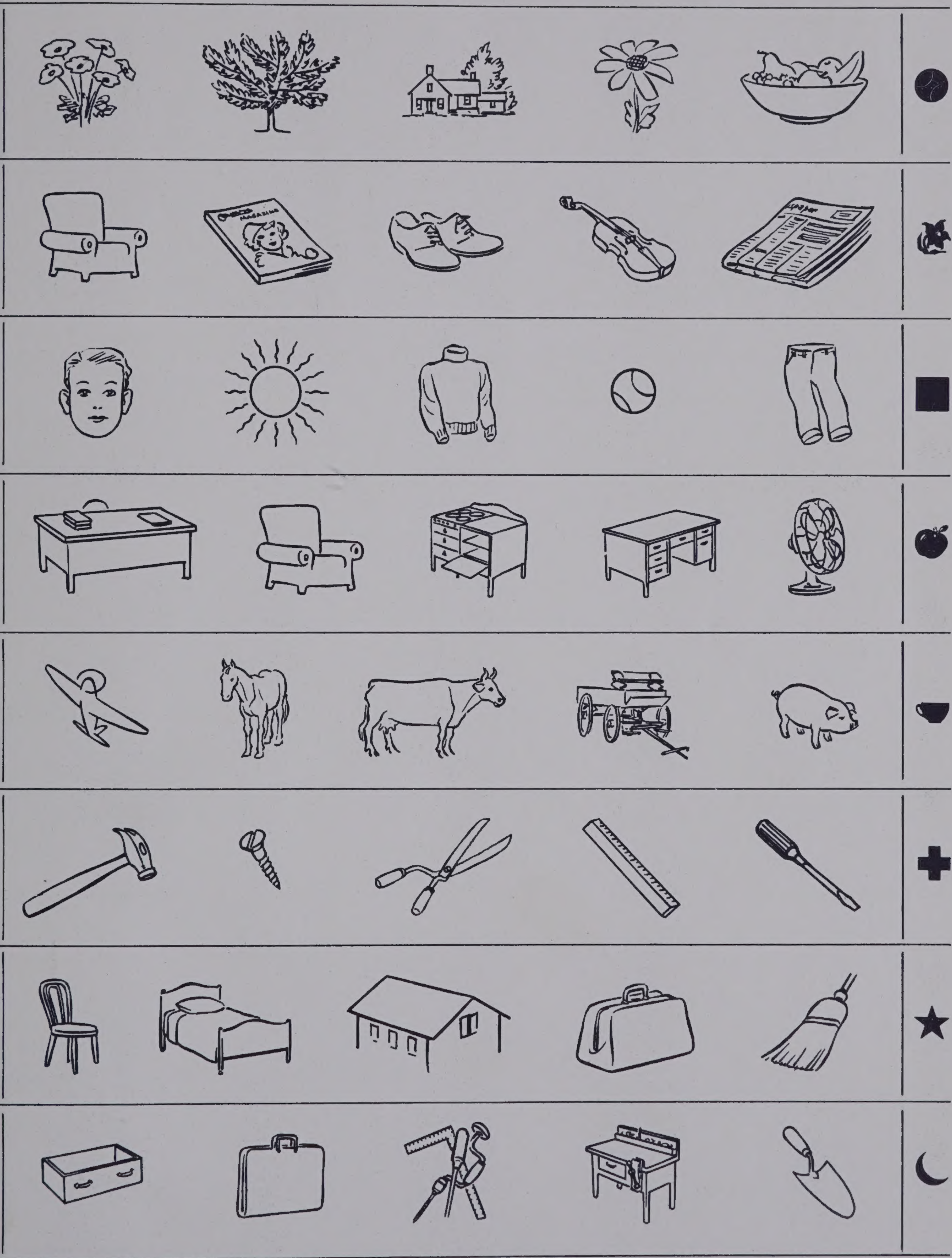


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